April 1939

# RADIO AND HOBBIES IN AUSTRALIA

VOL. 1 No. 1

## In this issue



## Next Month

*Building de-luxe receivers for all purposes—A new and very simple amateur short wave receiver—A microphone for 2/—A modulator for the 50-watt transmitter described in this issue—A specially designed model aeroplane, full constructional details—World Radio Review—New Components—All the regular features.*

# *Why we produced* RADIO AND HOBBIES

*A. G. Hull, Editor.*

THIS, the first issue of "RADIO AND HOBBIES IN AUSTRALIA," has been produced with a very definite aim. We want to give you a journal covering radio in all its branches, and, in addition, other constructional hobbies popular among so many.

Radio itself isn't just a single subject. It is a whole host of subjects. It covers electricity, mechanics, and sound. It has its romance, and its mathematics. It can lead to hundreds of little byways, each of which must be traversed in print, somewhere or other, in a magazine such as this. No other hobby can teach you so much about the wonders of the world in which you live.

But radio, as a hobby, is essentially something which leads to action, to building, to experimenting. It has this in common with so many hobbies which provide our hands with something to do. Therefore it is fitting that our magazine should deal with other activities which are thus allied to radio itself. Such things as Photography, Movie-Making, simple Workshop Practice, Model Flying machines and so on—all these are essentially active hobbies. Who knows whether the model plane enthusiast may not be led, through these pages, to radio, as an additional source of pleasure, or the radio man to moving pictures?

All these things provide us with self-expression which we can get in no other way.

There will be no compromise. We will publish articles which we consider will interest you, no matter into what strange paths they may take us. Contributions we welcome from men who can really do things, if they can also write about them.

We have worked very hard on this issue, but we know there is plenty of room for improvement. With any new magazine, this must be so. In future issues, we intend to include many things not seen here—particularly a "World Review" section to tell you what is going on in other countries, and a "Circuits Wanted" section. Also we intend to build up a very comprehensive "Information Service," and a "Safety Valve" to which all may contribute.

What will you do to help us make "RADIO AND HOBBIES" the magazine you think it ought to be? We hope you will write and tell us. We intend it to lead, and with your support, we are quite certain that it will.

*The Editors*

*John Moyle, Technical Editor*

# Congratulations from

## SIR ERNEST FISK

(Chairman of Directors, A.W.A.)

I have read the description of your new journal and congratulate you on the ideas you propose to incorporate in it.

I have the highest opinion of the latent technical skill and ability of our young Australian population and I think it is very good for a journal to be devoted to that side of their interests. Radio, photography, home movies, wood-working, metal-working, model-making, etc., are all excellent hobbies which provide enjoyment while helping to develop both mind and body.

The present young generation is entering a world which is becoming more and more intensely technical and scientific and those who are able to utilise their spare time happily in exercising mechanical and technical skill and extending their scientific knowledge will be best able to adapt themselves and to understand the very interesting period in which they are destined to live.

Science, mechanics and technology are proceeding rapidly in every phase of human life, not only in secondary production and entertainment, but also in primary production and in the development and maintenance of physical well-being.

*Sir Ernest Fisk.*

## PROF. W. J. DAKIN (Professor of Zoology, University of Sydney)

It is frequently and very carelessly and inaccurately stated that Science has brought nothing but trouble to the world. Actually few people, if any, would care to go back and live in the squalid middle ages with disease rampant and no anaesthetics for the barber's surgery! To-day it is no doubt true that applied Science has brought unemployment in some industries, but a glance at trade statistics will show that it has more than made up for it in new industries.

It is claimed to-day that a shorter working week is a necessity and that if machines bring any advantage to humanity it is to be NOT by cutting down employment, but by cutting out hours of drudgery and so giving everybody more time for their own lives. This is assuredly true, but already pessimists have been heard to say that things will be worse, and mankind less happy, if people do not know what to do with their spare time. There is in consequence, a growing urgent need for Hobbies. There have always been happy people with hobbies—including men of all ranks and pursuits, from engineers to statesmen. To-day the need is far greater than ever before. I look forward therefore, with great interest to this new journal. I trust above all things it will not underestimate the intelligence of its readers, and will supply some really good articles on the technical side of Radio, leaving film stars and announcers to their own journals.

I wish the new venture every success.

*Left: Prof. W. J. Dakin.*

*Right: Mr. L. N. Schultz.*

## MR. N. S. GILMOUR

President, I.R.E. (Aust.)

In offering my congratulations on the publication of your first issue of "Radio and Hobbies in Australia," I do so with the feeling that your efforts will play no small part in the home training of many thousands of youths and adults who have a leaning towards engineering. Under present world conditions there is the necessity for every country to protect itself from aggression and it is, therefore, essential to disseminate amongst our citizens as much technical knowledge as possible. With your valuable past experience, I feel sure the technical sections, covering in particular Radio and Communications, will be treated in such a way as to encourage young and old alike to make themselves familiar with the Art and thus fit themselves for greater achievements.

Best wishes.

*Mr. N. S. Gilmour.*

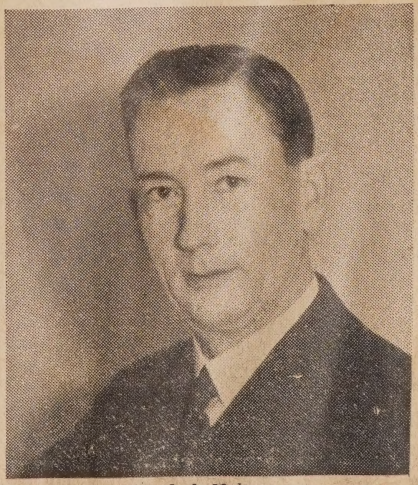
## MR. J. J. MALONE (Chief Radio Inspector)

Another journal devoted to radio in Australia is a sign of the development of the art and industry. If, however, it were concerned with radio only, the opportunities for its usefulness might be uncertain; we already have several journals dealing with the various activities of the radio industry and services. But in the form which "Radio Hobbies in Australia" will take it is evident that there will be a demand for the new journal and that it will be of unusual interest.

Associating radio and hobbies is a good idea. Radio is at once a profession and a hobby and there should be many opportunities for suggesting the employment of time usefully and pleasurably in the non-radio fields of the electronic art as well as in the purely radio domain. Some interesting sections of that domain are comparatively unknown to the average reader, who would be interested in the miscellaneous radio services which have developed in Australia and which are of growing national importance.

And, finally, the inclusion of a generous amount of space for Hobbies, as they are generally known, will surely be welcomed by very many readers.

All good wishes to the new journal.



*Mr. J. J. Malone.*

## MR. L. N. SCHULTZ

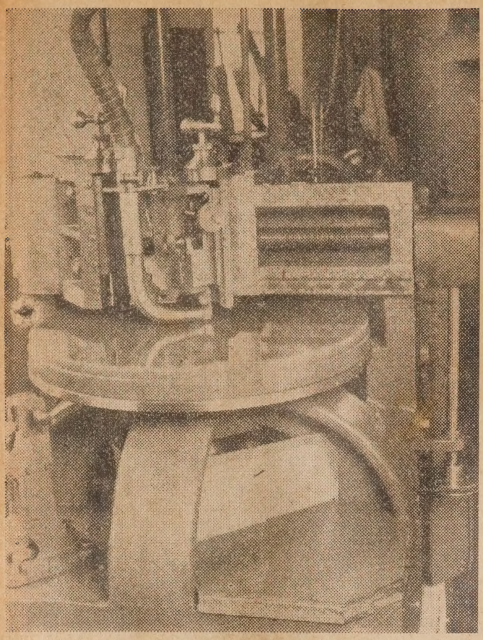
(Chief Engineer, Station 2GB)

I was pleased to hear from you that you are going to publish a monthly technical journal covering Radio and Hobbies in Australia.

There is no doubt that such a field has not been adequately covered in Australia and if it is written in a popular style, as you propose, then it will have a very wide appeal to the average man and should help him to obtain from the radio the best that it offers.

As the magazine is also going to cater for the technicians I expect that this will be well accepted because the technical side of radio is, at present, not well catered for by technical publications here.

Wishing the publication every success,



*This picture shows a wax disc ready mounted on one of the large polishing machines. Note the exhaust tube which takes away the wax shaving as it leaves the disc.*

# How GEORGE EDWARDS makes transcriptions

**The making of transcriptions is a very important part in the presentation of the radio programme of to-day. Particularly is this so in the handling of special sessions where it is impossible to do a direct studio broadcast. Advertisers who specialise in radio serial stories would be faced with an almost impossible task without some means of recording each episode, which can then be distributed over a large number of the stations for better service. This article tells how transcription records are made in the studios of Columbia Graphophone Co.**

GEORGE EDWARDS, the man of many voices, is at work. Through the glass windows of the control-room, we see him, with one or two members of his cast, and probably his wife, Nell Stirling, waiting, copy in hand, for the preliminary music to be faded out. At our side, the control-operator, his script before him, and his hand on the control, watches the clock and George Edwards, for the signal to begin. A final crash of music, and the operator eases off the control. George Edwards moves to the microphone. We hear his voice as the music dies away. Now he is Inspector Scott, a second later an unwilling witness, again, speaking over his shoulder to give the effect of distance, he is the learned judge. From time to time, other members of the cast speak their pieces.

One more episode is on the way.

## WHY RECORDING?

A man such as George Edwards, who has so many and varied sessions to produce, has long ago given up the task of handling them all personally. He realised that, in order to keep faith with his large audiences in Australia and overseas, a more flexible method had to be devised of presenting his programmes. Again, nothing could be left to chance—it is so easy to spoil an episode by some incident which, once it has gone out over the air, cannot be recalled.

So here in the studios of Columbia, he works every morning, recording his sessions on wax, later to be transformed into discs, a little larger than gramophone records.

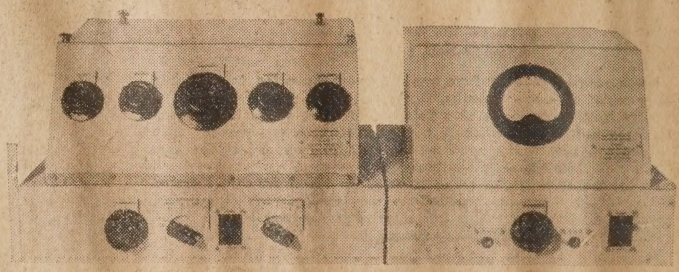
Before each recording is made, a round-table conference takes place, attended by all concerned, and the whole episode to be recorded is examined in every detail, to make sure that nothing is wasted, everything in the action is made clear, and everyone knows exactly where his or her part comes in. This is an important part of the day's work, for the whole effect would be lost if even one point were to be put over without its fullest effect being obtained.

## THE CONTROL OPERATOR

The conference over, and the scripts marked, each member of the cast keeps his copy, and one is given to the operator who handles the controls.

It is this man's job to bring in and out the snatches of music as required during the recording. To do this, he has before him a number of turntables, with the required records ready for him, and the control for each under his hand. A meter is also included on this control panel, which shows him exactly the volume level being recorded, for too much would spoil the cut of the wax, and too little would fail to give it the best effect. He may have three or four records to handle during one recording, so each of the pick-ups used has a scale attached to the arm, so that he can drop the point in the exact groove he required before fading it into the recording.

He must also gauge the level of the various voices, adjust their volume to suit, and, where necessary, signal to the actors on the other side of the glass partition dividing the recording-room from the studio whether they should come closer or move away. His



*The control panel on a recording amplifier. It allows for mixing a number of pick-ups and microphones, and includes a level indicator which prevents the operator from recording at too high or low a level.*

is a very important job, and on him rests much of the responsibility for the success of the morning's work.

## STUDIO EFFECTS

The search for realism in recordings has led to the adoption of many ingenious devices. For instance, there is a special effects table located in the new studio, which can handle a library of about 100 effects records (not all at once, of course!), even including a miniature public-address system as it would be heard in real life. This is simulated by having a small amplifier

*Mr. W. A. Donner, Managing Director, Columbia Graphaphone (Aust.) Pty. Ltd.*

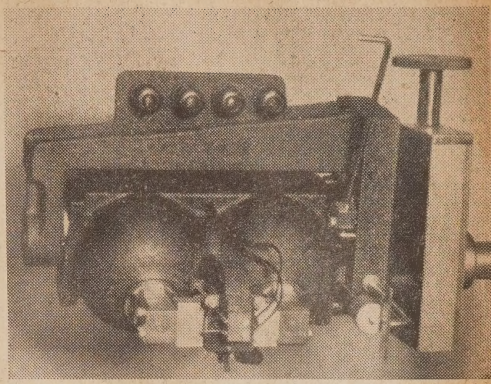
and loud-speaker unit all complete, through which the actor, located with his microphone in a far corner of the studio, can make his announcements or "put over" anything he wishes to be recorded. Door bangs, telephone bells and so on are simplicity itself to this ingenious set-up.

The new studio has been very carefully designed so that there is just enough reverberation or "echo," which avoids the dead sound of the voices were the studio heavily damped. To avoid reflections of sound backwards and forwards between the walls themselves, and between ceiling and floor, no two facing surfaces are parallel to each other. Any reflections from any one wall cannot meet another one at right angles, to set up "standing waves" and other undesirable effects.

Down the centre of the studio is a thick felt carpet. To one side of it, the floor is made of a hard cement surface for use where such footstep effects are desired, while the other side is made of wood blocks, which gives them quite a different character. Anyone walking on the felt cannot be heard at all. Nothing which will help towards realistic recording has been omitted.

## CUTTING THE WAX

So much for the actors. Assuming that everything has gone off well with the performance, let us see what is happening to the wax disc on which the sound-track has been cut.



*A close-up of a recording head. Note the huge field assembly for energising the cutting assembly. The stylus itself may be seen just resting on the bottom edge of the picture.*

It seems strange that, once the stylus of the cutting head has been lowered into place, no one takes any notice of the wax disc. It is revolving away merrily in its place, as if it had nothing to do with the actual performance. Once started, of course, it cannot be stopped until the whole recording is completed.

The waxes are stored in a special cupboard which keeps them at an even temperature, so they are always in good condition for recording. Nowadays, wax has improved so much that it isn't nearly as susceptible to temperature variations as once it was. Approximately 80 degrees is about right, and it so happens that the recording room is generally about this temperature anyhow. Another feature of the latest waxes is that the actual resistance offered to the cutting head is so small and so even that it can be neglected for all practical purposes. The cutter gives such a powerful cut that it would take more than wax to dam out its movement.

The waxes are driven by a speci motor which is connected to the turn tables by a cord drive. These moto are of considerable size, to make sur that they will not slow down or var in speed. Either of these, of cours would completely spoil the recording

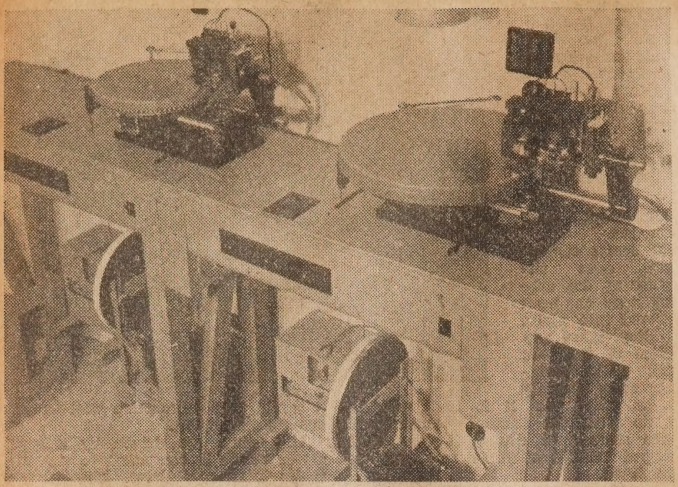
## THE CUTTING HEAD

The cutting head is of electromagnet design, and uses a specially groun sapphire stylus to make the actu sound-track on the wax.

The field magnets, which may b seen in the illustrations, are of enor mous size in comparison to the tin moving section attached to the cutte

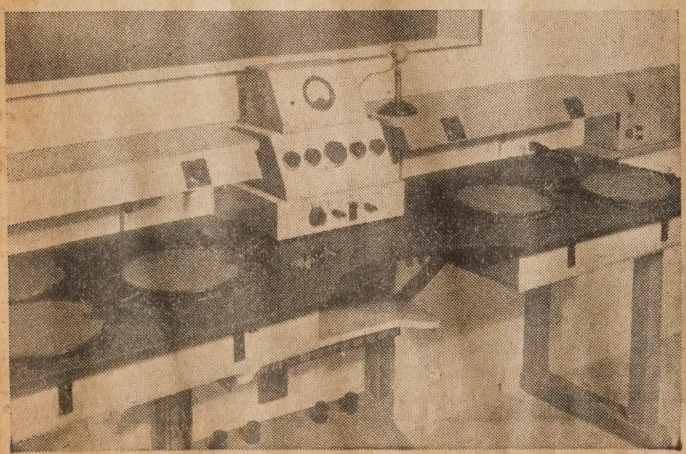
(Continued on Next Page)

*A famous trio. Left to right: George Edwards, Nell Stirling, and Maurice Francis who writes so many of the George Edwards productions.*



*Two cutting machines in position. Under the table are the motors which drive the turntables through a cord drive. Note the stroboscopic markings on one of the tables. The cutters are of the type illustrated on the previous page.*

*A general view of the factory where the finished wax discs are processed. The man in the foreground is handling one of the stampers from which the final discs are pressed.*



*One of the mixing tables, containing a number of turntables to handle effects and music to be faded into the actual transcription as it is being made. All of them may be controlled from the panel in the centre.*

and are energised with about 25 watts of power, much more than the average loudspeaker would employ. This is done to make sure that the field in which the armature moves is of constant strength—otherwise amplitude distortion might occur on heavily recorded passages where the movement of the stylus is at a maximum.

As the little shaving curls away from the wax, there is an exhaust tube which picks it up by suction, and carries it right away from the wax, so that it cannot fall back on itself and clog up the "cut." This tube is also to be seen in the photographs.

The cutting head is carried on a carefully designed carriage, which controls its "pitch" through a worm drive mechanism.

It is, of course, adjustable in every way, and one of the recording engineer's jobs is to adjust it for depth of cut, etc., before every recording is made. It is essential that this should be just right to within the tiniest fraction of an inch, otherwise the various discs would not be uniform. The highest degree of accuracy is required in making this adjustment.

## INSPECTION

After the cut has been made, the recording engineer makes a very careful inspection of the finished wax for any imperfections. Usually there are none, for he has watched the depth of the modulation on his meter all the time, he has heard everything which has been recorded through his monitor speaker, and knows that the script and effects have been properly blended. His experience is such that he can tell almost at a glance whether any one disc has been recorded too deeply in one spot, or has some other fault. Being a wax impression, it cannot be played back once it has been made. Thus this inspection is a very important process, as any defect cannot actually be heard until the expensive process of making the first record has been completed.

## RECORDING AMPLIFIERS

The amplifiers which drive the recording heads are elaborately designed, and provide an output of about 5 watts, 2½ of which are needed to operate the stylus to full amplitude. This amplifier also feeds the monitor speaker, so that the recording man can hear everything just as it goes to the record.

## HIGH GAIN

The overall gain of the amplifiers used is 120 decibels, which, in case you don't realise it, is enormously high. In spite of this, the hum level is practically nothing, and the overall frequency curve from 250 cycles to 8000 cycles is flat to within a couple of decibels (approximately 5 db. difference is required for the human ear to detect any change in volume). Below 250 decibels it trails off, until at 50 cycles it has dropped off about 12 decibels.

This is in conformity with standard recording practice, and if it were not done the bass would tend to overcut the grooves, and make recording conditions almost impossible. If required, compensation in the amplifiers which will play the records can easily be made to bring the bass up to normal level. This again is standard practice.


*One of the small studios from which talks, etc., may be recorded. Larger studios than this one are used where several people must be accommodated, and where action is likely to take place.*

## MAKING RECORDS

All these things have done their bit to contribute to the finished wax. Before it can be used, it must go through the usual processes which finalise in the production of the finished disc ready to be played in the studios.

The first of these processes is to cover the wax with a thin coating of graphite to make it suitable for electroplating. It is then given a heavy coating of copper, which takes 24 hours to form. This is done by immersion in a huge bath where the electro-plating process is carried out.

Next the shell is removed from the wax, cleaned down, and the surface given a heavy coating of nickel. This provides a hard clean surface which eventually in the presses will withstand a pressure of 72 tons per square inch, as the records are made from it.

## RECORD MATERIAL

The material from which the records are made is a mixture of many substances. Chief among these is shellac, which provides the main body of the record, and is the material which gives such a high polish to the finished article. A small amount of barytes and mineral earths are also included to act as a mild abrasive. Their purpose is to allow the needle point to grind itself into the shape of the groove during the first few revolutions of the record before the music starts. From then on, this abrasive action keeps the point a good fit until the special needles used for playing these transcriptions are worn out.

Extra body is given to the record by the inclusion of a proportion of flock, and Congo gum is included to give the disc a certain amount of flexibility, without which it might become brittle.

The materials are ground to a very fine powder which will pour almost like water. As supplied to the presses it is mixed into a plastic material.

## THE PRESSES

The pressing process is a combination of pressure and heat. The material is placed in the press, to which the stamping discs have been mounted, and the press itself is closed. Steam is fed into passages round the stamper, and the pressure is applied. After this, cold water is passed through the same passages to cool it down again, and when the press is opened, a warm, perfect duplicate of the original wax is lifted out.

This is then cleaned and the edges trimmed. The required labels were inserted into the press with the record material, so that they are found hard and fast, each in its place.

Thus the long journey of mechanical sound comes to an end, in a black, shining disc. It is a tribute to modern recording that one can scarcely tell from the final broadcast whether the performance is coming from a record or direct from the studio. Next time you hear one of George Edwards's productions, and others besides, you will perhaps have a better understanding and appreciation of the work that has produced it, and the meticulous care so many people have taken to ensure a perfect product.

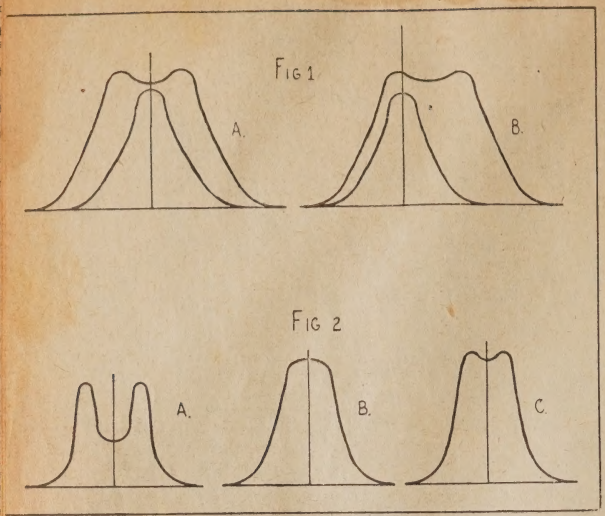



*Fig 1.—Showing good and bad examples of variable selectivity. In (A), the curve opens evenly on both sides of the intermediate frequency. In (B), the spread is uneven, causing radio frequency distortion.*

*Fig 2—The effect of Q in coupled circuits. (A) Q too high for given coupling. (B) Q too low. (C) Correct Q. Correct curve.*

# VARIABLE SELECTIVITY

## IN THEORY AND IN PRACTICE

The writer of this article, Mr. R. H. Errey, is considered to be an authority on matters of variable selectivity, having carried out work upon it in some of our most important laboratories. He gives here some valuable information concerning its application for the experimenter.

FOR the past five years there has been no radical change in the circuit design of the ordinary household receiver, but much effort has been made to improve the individual component parts in order both to reduce the cost of manufacture and to improve the performance of the initial adjustments. In spite of this, little has been done to make any substantial improvement in the tonal value, and, in fact, there seems to have been a general depreciation of fidelity.

### ATTENUATION

The improvement in selectivity has resulted in more severe attenuation of high frequencies, and just as the circuit has been standardised, so have been the tones of the instruments of the orchestra. The fiddle and clarinet have both been shorn of their high harmonies, which make them different from each other, and each a certain percentage of harmonics added to its note in the audio-end. Thus, the orchestra becomes a peculiar tone of its own—one big instrument—instead of a number of instruments each standing cleanly cut and crisp in its individual tone.

In the popular radio press, notably, "Wireless Weekly," many efforts have been made to reduce the harmonic distortion of the audio end of the set by such useful artifices as negative feedback. In itself, this is a step forward, but not a complete advance, as the resulting tone is "woolly" and unsatisfying. The main bass "boom" at the natural resonance of the speaker has been reduced, and the artificial high frequencies caused by distortion have been lost. The only manner by which the tone may be restored to something resembling the original—the actual instrument or ensemble—is to reduce the selectivity of the I.F. amplifier of the set.

When listening to local stations, the lack of selectivity is no obstacle, but on regional programmes, interstate stations, or short-wave channels, the receiver must tune sharply. The demand is present, thus, for variable selectivity, and as the set need only have two degrees of selectivity—local and otherwise—a two position switch seems a more logical arrangement than a continuously variable scheme.

### METHODS OF VARYING SELECTIVITY

There are two chief ways to vary the selectivity of a receiver without making the tuning unpardonably broad. One is to detune the primaries and secondaries of the I.F. transformers in

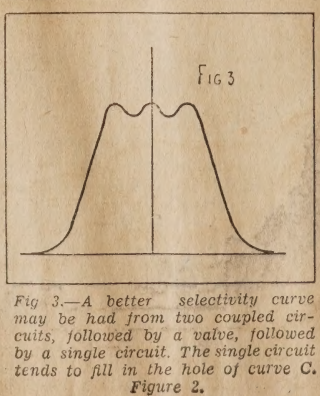



*Fig 3.—A better selectivity curve may be had from two coupled circuits, followed by a valve, followed by a single circuit. The single circuit tends to fill in the hole of curve C. Figure 2.*

different directions, and the other is to vary the coupling between the primary and secondary circuits. The results in both cases are the same, and the problem resolves itself into one of convenience.

In all cases, however, it is important that both the primary and the secondary must store the same amount of energy, that is, they must have the same overall Q. factor, for the broadening to be equal on both sides of the station's carrier frequency. Fig. 1 illustrates graphically the desirable and undesirable curves.

The overall, or effective Q. factor of a tuned circuit is the ratio of energy stored to energy dissipated per second, and it depends on the entire damping of the circuit.

### CIRCUIT DAMPING

The primary circuit of the first I.F. transformer is shunted by the plate resistance of the converter valve. An ordinary pentagrid of the 6A8G class has a relatively low plate resistance, and has considerable damping effect on the plate tuner. Where variable selectivity is used, it is wise to employ some valve with greater plate resistance, such as an octode or a 6J8G. The octode seems more prone to frequency drift than the triode-pentode (6J8G), and the latter is the logical choice.

The secondary coil of the first I.F. transformer is damped by the input re-

sistance of the I.F. stage, which, in turn, varies with frequency, and is actually positive above, and negative below the actual I.F. The result is a very undesirable assymetry of the selectivity curve—the "regeneration" effect. There are two ways of reducing it. The first, and least practical, is to use a valve with less plate-grid capacity in the I.F. stage. The more general method is to cut down the gain of the I.F. stage by reducing the number of turns on the second I.F. transformer, and using more tuning capacity.

In the second I.F. transformer, the damping may be fairly well distributed by feeding the A.V.C. diode from the primary winding, and the signal diode from the secondary. The delay voltage of the A.V.C. will be exceeded by any station likely to benefit by widening the channel, and the loading will be fairly well equalised.

## THE EFFECT OF Q

The overall Q. factors of the circuits have an important relation to the shape of the selectivity curve. As is shown in figure two, the very high Q. circuit may provide only "dog's ears," and not the desirable "flat top." Conversely, the circuit with too much damping (low Q.)

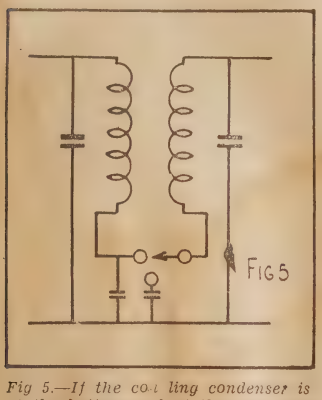



*Fig 5.—If the coupling condenser is at the bottom end of the coils, the circuit is simpler still, and the switch is not as "hot" as in Fig. 4. Cc and C2 are much larger in this case.*

has the effect of not permitting the flattening of the top. Where two circuits are spread, the Q. factors should never exceed 120.

Four tuned circuits, each with Q. factors of 120, even when spaced so far that their stage gains are cut to one quarter, cannot give sufficient selectivity to satisfy the current thirst for sharp tuning. However, where expense is a serious consideration, the four circuit scheme is good.

*Fig 6.—By using the circuit of Fig 5 in conjunction with two fixed circuits between the I.F. stage and diodes, the desired curve of Fig. 3 is to be found. The coupling condenser Cx is made by twisting one inch of standard hookup wire back on itself, and clipping the loop.*

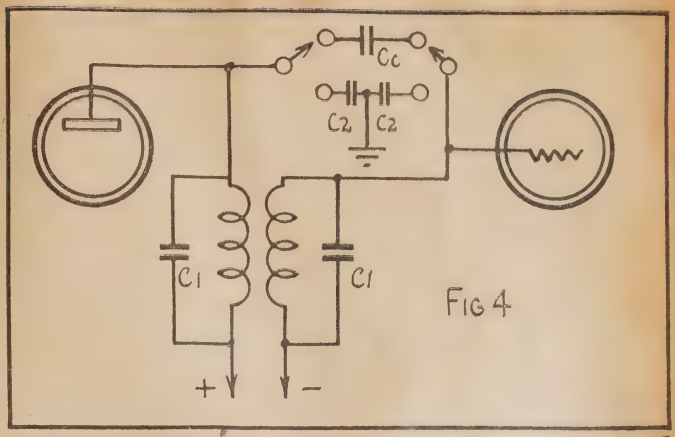



*Fig 4.—A simple scheme for switched selectivity variation. If the I.F. is 465 k.cs., and C is .0002 mmfd., both Cc and C2 should be .00001 each.*

## THE THREE-CIRCUIT SCHEME

About three years ago an idea was developed by an English radio engineer, W. T. Cocking, "Wireless Engineer," Mar., Apr., May, '36, to provide a very useful flat topped selectivity curve.

His scheme was simply to fill the hole between the "dog's ears" with another fairly sharp, third circuit. In its final form, the tuner used six tuned circuits, two pairs having variable coupling, and the last pair having fixed coupling. The interesting point of it all was that the fixed pair of coils had Q. factors of one-half the value of the variably coupled coils, in order to give three equal pumps like those of figure three.

To use his six circuits, he did not use another I.F. stage, though such could be used with advantage. To keep costs down, however, it may be better in the last analysis to use his scheme with a band-pass, four-circuit tuning scheme between the converter plate and I.F. grid, and to leave the fixed pair of tuners between the I.F. plate and diodes.

## DETUNING VERSUS VARIABLE COUPLING

At least one high priced American receiver uses the detuning method of widening the tuning curve, or, in their own more explicit and concise words, "expanding the selector!" Mechanically, it is clumsy, as it is continuously variable. If it used a switching device it would be difficult to reduce capacity coupling between leads sufficiently.

Where the coupling between coils is varied mechanically, by adjusting their axial distances, there are two obstacles to be overcome.—one is the translation of the rotary motion of a shaft to the axial motion of the coils, by some cam drive mechanism, and the task of making permanent flexible connections to the coil from the rigid parts of the tuner.

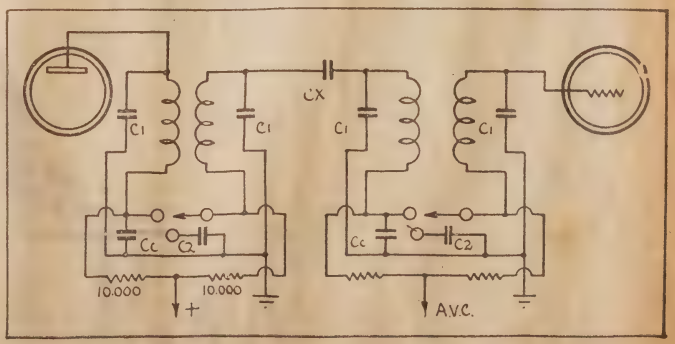
Although the difficulties are not insurmountable, they are enough to deter the serious experimenter, in view of the fact that all he needs is some switched device.

One contrivance for varying the magnetic coupling switches in a few extra coupling turns wound close to one coil and connected in series in the other tuned circuit. If the expansion is symmetrical in such cases, it is more generally a matter of luck than design, as the tuning must be varied as well as the coupling.

## OTHER METHODS

A method of varying the capacity coupling, tried by the writer early last

(Continued on Page 13)



# An elementary COURSE IN RADIO for beginners

**Being a very elementary course of Radio study for those who wish to know "what makes the wheels go round."**

By L. B. GRAHAM, Principal of the Australian Radio College, Pty.,

RADIO represents to thousands of Australians a most exciting and interesting hobby. To many more it represents a lucrative and interesting career, and to the majority of people a pleasure for which there is no comparison.

This elementary series of articles is designed by the Australian Radio College to give those interested in radio a start with solid foundations on which may be built an all-absorbing hobby or career. While no pretence is made that this is a thorough and complete engineering course, it is felt nevertheless that it will be of great interest to those who wish to know just a little of this fascinating subject.

Radio is an offspring of electricity, and to fully appreciate its character it is necessary to study first of all the ways and habits of the parent.

## THE UNKNOWN

Electricity is still treated with awe, as something altogether unknown, but although we can only advance theories regarding its origin, there is now a vast amount known about its action.

In all radio and electrical work, electricity is used only as a conveyor of energy. A very apt analogy in this case would be a comparison between electricity and the belt conveying power between an engine and a machine, the belt is not used up in the process of conveying this energy. Electricity, like the belt, is always present in a circuit, and when some force such as a battery or generator is applied to a circuit, it creates movement of the electricity. This movement conveys the energy obtained from the generator or battery around the circuit. The energy only is used, the electricity continuing to move round the circuit until the force creating that movement is removed.

Just as a belt continues to travel round and round, between an engine and a machine, so electricity travels round and round a circuit between the battery, generator or other source of energy and the device in which the energy is expended.

## ELECTRICAL PATHS

To enable the electricity to continue in its circulating path it is obvious that an electric circuit must consist of a path by which electricity can flow from the source of energy to the load and from the load back to the source and so on.

Electricity may also be used to store energy in a device known as a condenser by creating a strain in certain parts of the condenser called the dielectric. This strain may be used to do work. A wound-up clock spring illustrates this effect. It required energy to wind the spring, but that energy is stored and can be made to do the work of keeping the clock going.

To analyse the action of electricity two units are used, voltage and current. Voltage is a measure of the pressure at which electricity works, it may be compared to a pressure of steam which would be measured in pounds per square inch. Voltage then is really the "pounds per square inch" or "pressure" of electricity.

Current is a measure of "rate of flow," the unit of measurement being an amp., which is equal to a certain quantity of current passing a point within a given length of time. This is the equivalent of gallons per minute in the measurement of water.

It requires a pressure or voltage to create a movement of current just as it requires a pressure to create movement of water in a pipe. It is impossible to have a current flow without pressure. Pressure can exist, however, without a flow of current. When a water tap is closed there is no flow of water, but pressure exists behind the tap ready to create a flow immediately the tap is turned on. Similarly, current can be stopped by opening a switch in an electric circuit, but the pressure will still exist in the circuit.

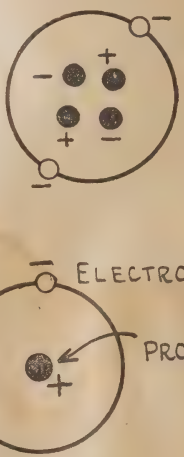



*Fig 1 (top): A helium atom, the second simplest in construction, four protons and four electrons. Bottom: Hydrogen atom, the simplest of all—one proton and one electron.*

Having dealt with some of the characteristics of electricity it is now necessary to become a little more technical on the subject. Of all the theories of electricity the "Electron theory" is the most suitable, as by means of it we can find explanations of far more electrical phenomena than with any other means, consequently we will use it in the following explanations.

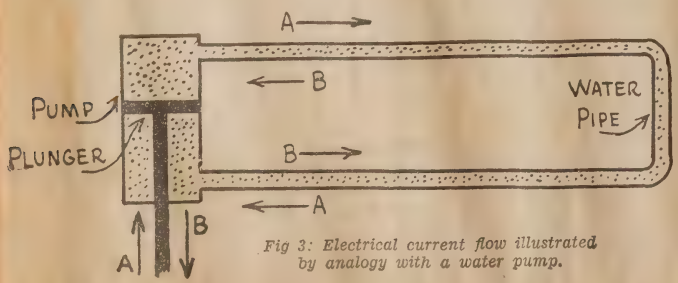



*Fig 3: Electrical current flow illustrated by analogy with a water pump.*

# COURSE IN RADIO,

(Continued from Previous Page)

Briefly, all matter is composed of elements either singly or in various combinations, in which case they are known as mixtures or compounds, e.g., hydrogen and oxygen are both elements, when they are combined in certain quantities they form water, $H_2O$, which is a compound.

There are all told 92 different elements and the smallest particle into which each can be divided while still retaining its same characteristics is termed an atom. An atom can then be divided into protons and electrons. The protons are positive charges of electricity and form the bulk of the atom, and therefore, of course, the bulk of the matter. The electrons are negative charges of electricity and revolve around the proton in a similar manner to the movement of the planets around the sun.

## FORMATION OF ATOMS

The two diagrams give the electronic formation of two simple atoms. Hydrogen is the simplest, having only one proton and one electron. Helium, which is next, has four protons and four electrons. The four protons and two electrons are in the centre, and it has two electrons which rotate in an orbit around the centre nucleus. Copper has 64 protons and electrons, 29 of the electrons revolve around the positive nucleus or are planetary electrons.

Although the electron is very minute in comparison to the proton, each electron exactly neutralises the charge of each proton, so that an atom in its normal state is neither negative nor positive; it is neutral.

The laws of physics state that like poles repel and unlike poles attract each other. Positive and negative would tend to move together, two negatives or two positives tend to move apart. An electron being negative will move towards a positive potential.

## CURRENT AND ELECTRONS

In a piece of copper wire or similar conductor, the electrons are not held very securely by their atoms, and may drift around at random in all directions in the wire, but if the wire is connected to a battery or generator these electrons will be attracted by the positive pole of the source of energy. Instead of a random drift in all directions the electrons will now move in the direction of the positive pole. This drift constitutes a flow of current. The electrons do not flow at any great speed towards the positive source, but the energy conveyed by their movement travels at the rate of 186,000 miles per second, that is the end electron in a piece of wire one mile long would commence to move 1/186,000 part of one second after the first one, even though the movement of each electron is somewhat slower.

It requires a movement of a tremendous number of electrons in one second to form one amp of current flow, the number being 6.29 x 10 18. This represents 629, followed by sixteen noughts.

There are two forms of electrical current, direct and alternating. The explanations given refer to direct current which flows in one direction all the time. Alternating current, which is by far the most important in radio, is repeatedly changing its direction of current flow. It flows for a certain length of time in one direction, and then reverses and flows in the opposite direction for a similar length of time.

## WATERPUMP ANALOGY

Once more using water as an analogy —if a double acting pump and piping were arranged as Fig. 3 (previous page), the upstroke of the pump would result in the flow of water as shown at "A." The down stroke would result in movement shown at "B." Any small section of the water may travel only a short distance around the pipe before the pump acts in the reverse direction, it must then move back to its original position. Substituting an alternating current generator for the pump and an electrical circuit for the pipe, the same holds good for electrical current as for water. As the pressure rises in the generator, current flows in one direction, as the pressure falls, current ceases to rise again in the opposite directions when pressure from the generator reverses.

It is only the movement of current which conveys energy, and consequently it is immaterial which way the current is moving it still has the ability to do work.

The number of times which an alternating current goes through the cycle of flowing first one way and then the other in one second, is termed the frequency of the current, i.e., a current which flows first one way and then the other 50 times per second has a frequency of 50 cycles per second, as each complete sequence is one cycle. The ordinary house installation operates at a low frequency of 50 cycles per second. whereas in radio we have to handle frequencies of 20 million cycles and higher. The handling of such high frequencies requires considerable skill and an intimate knowledge of radio principles. We will examine the action of these high frequency currents in the next issue.

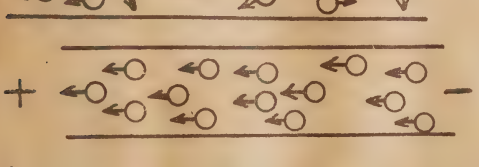


*Fig 2: Showing the electron grouping in a copper wire with and without current flow.*

# Variable Selectivity

(Continued from Page 11)

year, used a special differential condenser for continuous variation. In Cocking's circuit it was entirely satisfactory, but it took all the resources of a well-staffed, well-equipped tool room about a month to turn out satisfactory samples of the condensers. It had to be simplified for universal acceptance.

The trick in all methods dependent on capacity coupling is to offset the change in total circuit capacity in coupling, with just sufficient capacity to keep the symmetry when the coupling is reduced.

One simple and satisfactory scheme is shown in figure 4. When the switch is in the broad position there is a certain extra capacity introduced into each tuned circuit by the coupling condenser Cc. On changing over to sharp, extra condensers, C1, C2, are switched in across the tuners, and the peak appears correctly at the mid-point between the two peaks of the broad position. The capacities of the condensers may be roughly ten micro-microfarads if the tuner is about 250 micro-microfarads. Suitable condensers are the fairly recent silver-sprayed ceramic cup shaped type supplied by an English firm.

The placing of the switch has a very material effect on the performance of the above system, as it is very easy to increase the capacity between grid and plate of the I.F. stage and upset all one's good work.

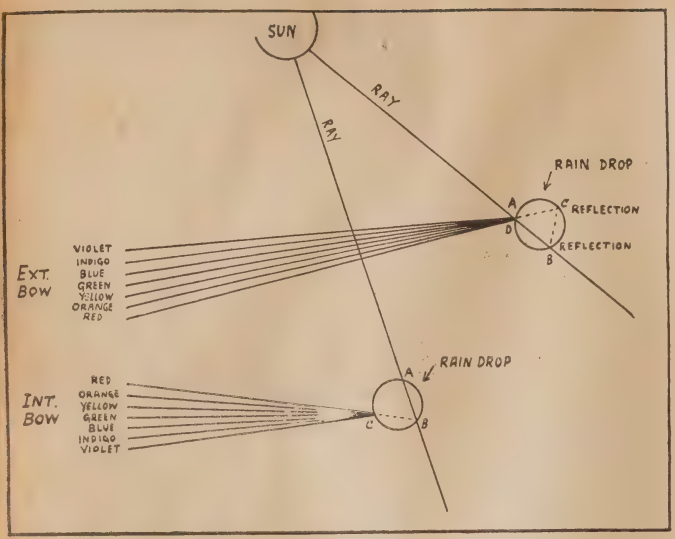
Rather than couple the top ends of the coils, and use voltage coupling, it is possible to use current coupling, or "bottom end" coupling, as shown in figure 5. The R.F. voltage between the switch and ground (chassis) is a very small portion of the actual voltage across the coil, and capacity between switch and other active parts of the circuit has very little harmful effect on operation.

The scheme may be applied to ordinary home constructors, I.F. transformers, by pulling the coils about 25 per cent. as far apart again, and taking connections down to the switch. Suggested valves are .005 microfarads for the coupling and compensating condensers. They should be non-hygroscopic—ceramic cased condensers will do.

In figure 6 the idea is intended to provide Cocking's triple humped curve. The I.F. transformers should have tuners of approximately .0002 microfarads, and may be ordinary home constructor's pattern, spaced out.

The fixed coupled I.F.T. is the same as the others, but its Q. factor is reduced approximately to one-half by the damping of the two diodes.

This idea is still in the nebulous stage of experiment, but so far it has proved both simple and useful in providing what no manufacturer seems generous enough to give.




# The RAINBOW round your shoulder

**The rainbow is one of nature's eternal wonders. What makes the colors? Where does it begin? Where does it end? Our correspondent tells you about these things in his own racy manner.**

By CALVIN WALTERS

"THERE'S a Rainbow round my shoulder and a sky of blue above" (Al Jolson). "And we'll all go riding on a rainbow to a new land far away" (Gracie Fields). "There's a rainbow on the river" (Bobbie Breen). Which all goes to show that a rainbow besides being a good subject for a song is also a most versatile object, capable of being used for such purposes as a shoulder decoration and a vehicle of transport.

I am also reminded of the small boy's definition of a rainbow. He said, "When Noah came out of the ark after it had stopped raining he wanted some guarantee that it wouldn't rain such a lot again. So the Almighty put a rainbow in the sky and told Noah that while the rainbow was there it wouldn't rain again. In order to seal the bargain the Lord hung a bag of gold on the end of the rainbow as security. This made everybody greedy and they have been looking for the bag of gold ever since."

The last part of this definition is true enough, and while I personally have never got to within coo-ee of the end of the rainbow there are some people who never seem to have any difficulty in finding it. It seems to exist in several places. For a Chicago bandit it is in the vaults of a bank. For politicians it is in the pockets of the public. And the way my rent is going up lately it seems to be somewhere around my house as far as the landlord is concerned.

## NATIVE WORSHIP

I understand also that a rainbow is considered to be a God of some sort in various parts of the world. The natives apparently worship the bow because of its pretty colors. Which brings me to my subject—do you know what a rainbow is? No doubt you have often used the term, "as many colors as the rainbow," but do you know what those colors are? Before you read any further just think for a minute and see if you do know the colors. In case you don't, here they are: Violet, indigo, blue, green, yellow, orange and red. Seven of them.

They are called the colors of the spectrum and the spectrum is the band of colors that appears after a beam of white light like sunlight has passed through a glass prism. You know that light does not pass straight through a glass prism, but is bent on the way through and how much it is bent depends on the color. Now believe it or not, white light is composed of those seven colors and as violet can be bent more than the others it appears at one end of the band; indigo is bent a little less, and it comes next, and so on for the rest of the colors.

Now, if you receive the colors on a small mirror, a mirror for each color, and focus the light from each mirror on to the same spot you will get white light again. The band of colors you often see on the lounge room wall when the sun is being reflected from a mirror is a spectrum.

## WAIT FOR THE RAIN

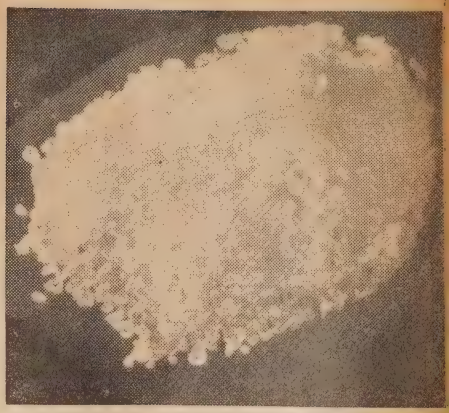
We will now attack the rainbow. The best time to see a rainbow is on a week-end when it is raining. It always rains then. Or, if the forecast in the paper says fine, you will probably see one then, too. It is necessary for the sun to shine also. So we then have one of those forecasts which says passing showers, otherwise fine.

Now if you turn your back to the sun and look in the direction of the rain, you have the conditions required for the formation of a rainbow. There are often two bows to be seen. One inside the other. The interior one is always the brighter and we will deal with that one first. The rays of light fall on the UPPER parts of the raindrops. The light, by refraction, will be bent and thrown upon the inner part of the spherical surface of the drop. By reflection it will be thrown to the lower surface, where by refraction it will be bent towards your eye. Fig. 1. Hence by two refractions and one reflection the colors of this bow from the UPPER part are red, orange, yellow, green, blue, indigo and violet. The exterior bow is formed by the sun shining on to the LOWER surface of the drop. The ray is bent as before, once when it enters the drop and once as it emerges to the eye.

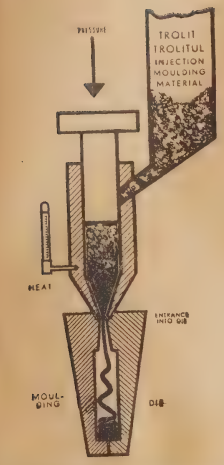
But it undergoes two or more reflections inside the drop and so is diminished somewhat in intensity and the colors are reversed, namely from the UNDER part they are red, orange, yellow, green, blue, indigo, and violet. Did you notice that before? Now your eye is the apex of a cone with the rainbow as the base. Consequently you can never see more than half the circle of the bow, for if you draw an imaginary line from your eye downwards at an angle equal to that from your eye to the top of the bow, you will strike the ground. But if you were on top of a very high mountain you would see a complete circle. You can also see a complete circle if you form a small rainbow by spraying your garden hose above your head with your back to the sun.

# TROLITUL

## A MODERN PLASTIC INSULATOR



*The raw material ready for the moulding process.*




**Those who read of the new season coil kits will see that they feature Trolitul as an insulation, and some may ask for further details of this plastic, and how it is made and worked.**

DURING the past 20 years there have been wonderful strides made in the progress of plastics, especially moulded bakelite and similar compounds.

In the radio industry the application of plastics has become very general, and even cabinets are to-day being manufactured out of moulded bakelite. The moulded cabinet is proving exceptionally serviceable in use, too, withstanding scratching and rubbing, and retaining its original finish almost indefinitely.

In the smaller components the use of mouldings has become popular, but some of the earlier materials used did not have good electrical properties.

But now we have a compound from Germany which has been developed for radio frequency efficiency, and this is the product known as "Trolitul," and is being used extensively for coil formers, condenser mounts, and other parts where high-efficiency and low-loss characteristics are desirable.

Trolitul is a hydro-carbon compound which melts at fairly low temperatures and is moulded to any desired shape by the application of a little pressure and heat. The moulding is being done locally.

### WATER RESISTING

One of the many advantages of the compound is the way in which it resists water and humidity, and on this account it is expected to have considerable advantages over other compounds when it comes to such applications as the core of an intermediate transformer.

### CLEAR OR COLORED

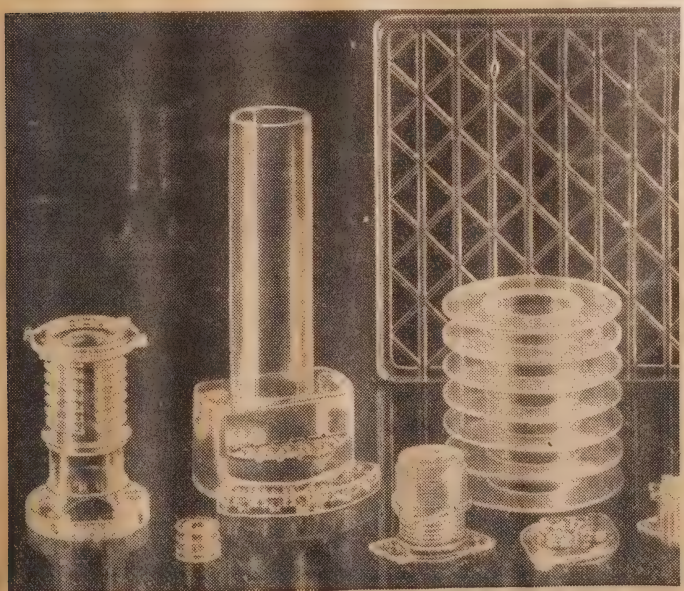
Trolitul can be obtained in a glass-clear form or it can be obtained in any one of several dozen different colorings and shadings. For radio use the clear and the cream colorings appear to be most popular.

### VERY LIGHT

The Trolitul moulding is very light, almost light enough to float, yet very strong, in fact almost unbreakable.

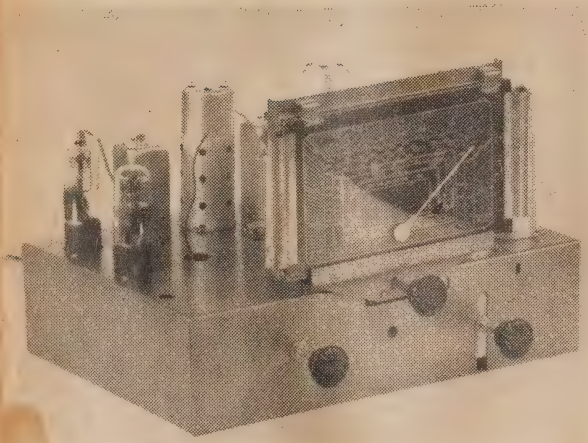
### HIGH RESISTANCE

Both internal and surface resistance characteristics are given as "infinity," and the electrical breakdown resistance as 50KV/mm.



*The finished article, in clear Trolitul. Colors are also available, and an opaque cream is also popular for radio work.*

# The ECONOMY SIX battery receiver



*A front view of the receiver. Controls are battery switch, tuning dial, wave-change switch, reading from left to right. Note wire for connection to "C" battery.*

Here is the latest development in battery sets, using the most recent types of valves released in Australia. It has been designed as a bigger type of set which undoubtedly gives you more for the same battery outlay than any other set you could build. Specially meant for the man who wants the best daylight reception consistent with utmost economy. There are no batteries to charge with this set.

THIS is a battery receiver which has been designed to give excellent reception on both short waves and the broadcast band, using the new 1.4 volt valves.

We have called it the Economy Six, because it is doubtful if one could build a set of its type to use less battery power and give the same results.

The 1.4 volt valves have been developed for the express purpose of reducing battery drain. Their filaments being of the 1.4 volt type, do not need an accumulator, but can be run from a dry-cell battery. The current consumption of all valves except the output valve is only .05 amps each. The output valve draws 1 amp, so that the total drain on the set in the filament circuit is .35 amps. And this at 1.4 volts.

This is only a little more than three of the standard two volt valves require at two volts, so you can see what we have gained already.

However, the B battery supply for these new valves is, as most people now realise, only 90 volts. At this figure the total drain of the set we have built is about 10 mills on a strong local station, and a couple more on weaker ones. This is a little lower than the average two volt set, which, however, needs 135 volts for the job, or one 45 volt unit more than the new receiver requires.

The output from the set isn't low, by any means. The output valve we have used has a maximum power delivery of 240 milliwatts. This is a bit lower than the standard two volt output pentode, but no one ever uses such a set at its full output, so that, in effect, we don't lose very much here.

## LOWER EFFICIENCY

As we can't get something for nothing, we must admit that these 1.4 volt valves, stage for stage, are not quite as good as the larger types. The difference, however, is not as much as one would imagine. On the broadcast band it is doubtful whether there is much to be noticed in practice, as again few people ever run their sets at maximum gain.

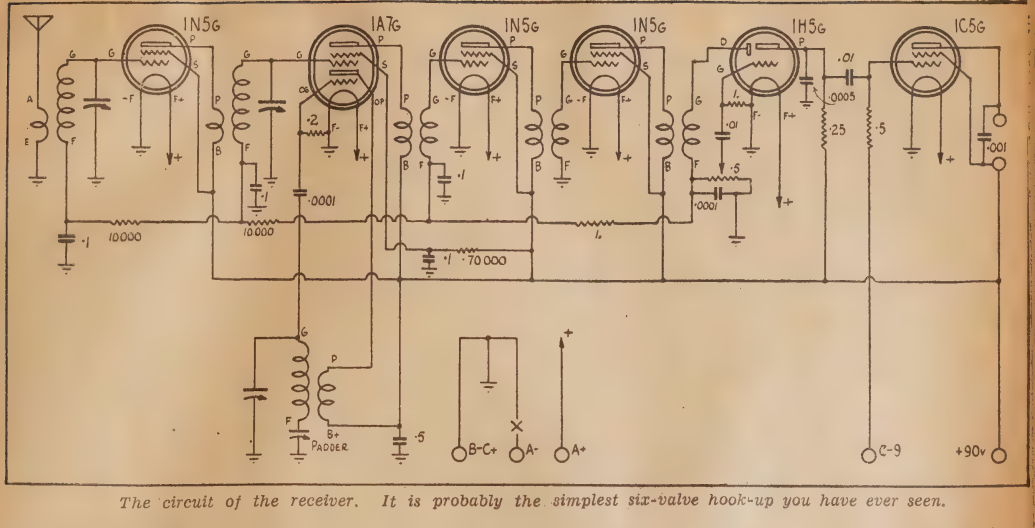
On short wave, the difference is more marked. We have seen sets in the laboratory, with very carefully made and adjusted coils, which give very good short wave results with a single intermediate stage.

Our experience, however, is that to make a set which we can compare with the "big boys" in the battery world of the past, it is a far better proposition to use two intermediate stages, and avoid the troubles we are liable to meet when trying to get the last ounce from a single stage, as we would probably have to do.

In all our set designs we never lose sight of the fact that the constructor must be given something up his sleeve. When we tell you, therefore, that you will get excellent sensitivity from this set, not only on the broadcast band, but on the short waves, we are only saying something we have found to be the case. We have spent quite a bit of trouble in checking over circuits, and coils, in an endeavor to make sure that the valves

**WARNING**

Under no circumstances must this set be connected directly to a 2-volt accumulator. The valves are made to operate from 1.4 volts, and 2 volts will quickly ruin them. Two-volt accumulators require 2-volt valves, which, however, should not be used in this circuit.




*The circuit of the receiver. It is probably the simplest six-valve hook-up you have ever seen.*

can be decently operated on short waves. Our experiments have been sufficiently successful for us to release this set, in the belief that it will prove in its own way to be just as reliable and efficient as others which have been so famous in the past.

## THE COILS

We would point out at the start that if you build the set with a kit of coils designed for operation with the standard converters, such as the 6A8 or the 1C6, your results will not be as good as those obtained by the use of the specially designed coils not available. The difference lies in the oscillator circuit, and our old friend, oscillator grid current, which is an excellent foot-rule by which to measure the efficiency of the converter. The standard coils will show a tendency to drop out of oscillation at the lower frequency setting of the dial, although they will work quite well with the condensers well out of mesh.

However, this is a point that won't trouble you if you make sure you specify coils made for the 1A7G oscillator. It will work quite well enough with the right coils to give you full speaker reception of all the regular short-wave stations on all the short-wave bands.

On the broadcast wavelengths you will find it an excellent distance-getter. In Sydney, we were playing 3AK, Melbourne, for instance, late at night, with all the punch and clarity one could desire.

## THE CIRCUIT

There is one point about these valves which allows for a very simple circuit. That is that the plate and screens of the R.F. amplifiers operate at the same 90 volts. There is no need to provide a special lead to feed the screens, as they all tie back to the same point.

The only exception is the screen of the 1A7G. This requires 45 volts only, and we have obtained this from a dropping resistor and bypass condenser you will find in the diagram. It would be O.K. to use a tapping to get this voltage, but as it would have to be bypassed anyhow, you would only save a single resistor, and add another lead to the B batteries. The use of the dropping resistor means that as the batteries wear out the voltage will be reduced here in proportion.

We have operated the set quite well on considerably reduced voltage—67½ volts still allows good reception. However, batteries which are down to this mark are due for replacement anyhow, and don't put up with the poorer results just for the sake of keeping the set pegging along for a few weeks more. The difference isn't worth it.

## PARTS LIST

1 Chassis, 14 x 10 x 3½ inches.
1 Dual-wave tuning unit matched for 1A7G valve.
3 Special intermediates to suit (460 k.c.)
1 Tuning dial to match coils.
1 3-gang tuning condenser to suit coils.
1 .5 meg. combined volume control and switch.
2 1 meg. resistors.
1 .5 meg. resistor.
1 .25 meg. resistor.
1 .2 meg. resistor.
1 70,000 ohms resistor.
2 10,000 ohms resistors.
1 .5 mfds. tubular condenser.
4 .1 mfds. tubular condensers.
2 .01 mfds. mica condensers.
1 .0005 mfds. mica condenser.
2 .0001 mfds. mica condensers.
1 .001 mfds. mica condenser.
Sockets—6 octal, 2 4-pin.
Valves—3 1N5G, 1 1H5G, 1 1C5G, 1 1A7G.
Batteries—2 45-volt Triple Duty types, 1 9-volt C battery, 1 special 1.4-volt A battery.
3 Knobs, hook-up wire, solder lugs, etc.

## A.V.C.

The circuit uses A.V.C., which controls the first three valves. These are all of the zero-bias types, which means that no bias is needed for them. Again this helps efficiency.

The last I.F. amplifier, in accordance with accepted practice, is not controlled. Often overloading will occur at this valve if it is controlled, because the bias applied will prevent it from adequately handling the considerably amplified signal which appears at its grid. We tried leaving the control off the converter, which we have often advocated, but didn't find any advantage in sensitivity or anything else.

The 1H5G, which is the diode-triode second detector, has only one diode plate. Therefore we are forced to use the simple A.V.C. circuit whether we like it or not. Actually, it works as well as any in levelling out the stations and that's its main purpose.

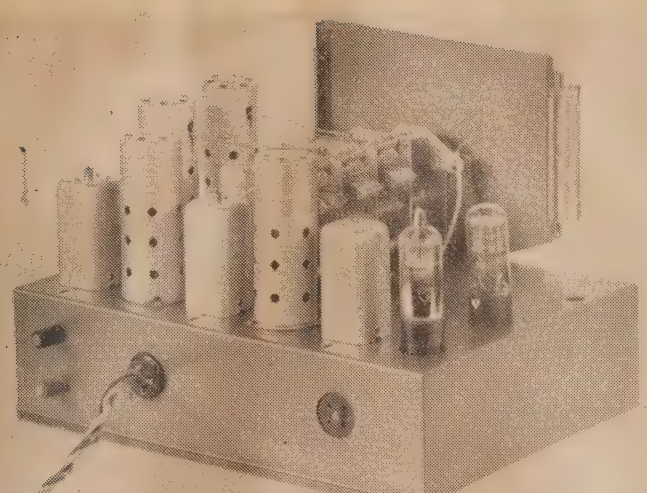
Incidentally, this 1H6G is also a zero bias high-gain triode, so don't think we have made a mistake when you see that there is no bias applied to it. It just seems that everything about this set has conspired to force us to use simple circuits, and in the interests of simplicity we can only register approval on this count, if on no other.

## HOOKING UP THE A.V.C.

The special coil assembly is similar to the one used for the Sky-Hound A.C. set, and as far as connections go, it is very convenient. As you will see, there are a couple of terminals on the coil strip which are blank, having no connections made to them from the coils. We have used them to form convenient mounting lugs for some of the components, and they will save you using extra insulated lugs in your efforts to make a good job.

The A.V.C. circuit used employs the series connection, which again we used mainly for convenience.

It allows us to bridge the decoupling



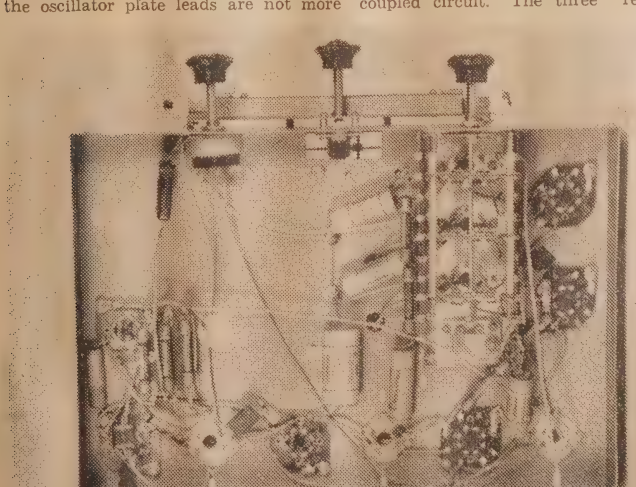
*The set from the rear. The battery leads are plugged in their correct socket, the other is for the loud speaker. Note grid leads running over the coils to the connecting lugs of the gang condenser. Also the lead for connection to minus 9 volts of the "C" battery.*

resistors straight across from one lug to another, and the bypass condensers make connections to the earthed network connected to the earthing pieces of the gang condensers. Taking it all round, this coil unit is easier to wire up than any other we have used to date, and you will find the other leads just as convenient. For instance, the oscillator grid condenser will probably bridge straight from the socket to the coil lug without any further leads being connected to it. The R.F. plate and the oscillator plate leads are not more than about one inch in length.

The wiring diagram illustrates the cleanness of connection more than anything else could. As a matter of fact, the whole set took only about one evening to wire up, with the chassis ready cut to fit.

## AUDIO SECTION

The audio stage is again quite straightforward, using a simple resistance-coupled circuit. The three resistors,



*The wiring is very simple, as shown by this under-chassis photograph. Particularly notice the mounting of the A.V.C. condensers and resistors.*

which are mounted on a panel, are t 1 meg. decoupler for the A.V.C. line, t 1 meg. grid leak for the 1H5G, whi is earthed at one end, and connected the grid by a lead through the chas at the other, and, finally, a .5 meg. gr leak for the output valve.

This valve, the 1C5G, is the bigg of the two pentodes available, and has 240 milliwatt rating against 100 mil watts for the smaller job. It requir a bias of 9 volts negative. This is o tained from a 9 volt bias battery, whi stands on the top of the chassis. Th battery could, of course, be housed the cabinet with the rest of them, b we have always put it on the chass where possible, where it is out of th way, and easily connected. We alwa believe in keeping the leads to the ba teries as few as possible—the fewer t leads, the less chance there is of gettin them connected the wrong way round

The positive end of the C batte may be earthed anywhere to the chass —a solder lug bolted to the frame of t gang condenser is as good a place any.

## VOLUME CONTROL

For convenience sake, we used a com bination volume control and filame switch. This saves the necessity for a extra switch, and makes the one con trol do both jobs. As the volume con trol is rotated in one direction, th volume is reduced until it is shut o altogether. If the switch is now turne still further round, the switch snap over, and turns the whole thing off.

If you want to use dial lights, yo can use the third hole in the chass for a switch to cut these off when no required.

If you do use dial lights, make sur they are of the lowest consumption typ you can get, because the power the take means so much less life for the battery. Always turn them off aft you have tuned in—make it a strict ru until it becomes habit.

## THE BATTERIES

The batteries for this set have bee specially developed for the 1.4 vo valves, and there is a cell put up by th Ever Ready Company which will give long life with them. You should get th best part of 800 hours of life when usin a single cell, and on the basis of abou three or four hours a day, this is quit a decent period of operation. A sing dry cell of the buzzer type is sometime used, but naturally, its life cannot b compared with the bigger job, and it poor economy to use anything else. though it is fascinating to hear the se working for quite a few hours off a singl 1.5 volt torch battery!

The B batteries may be of the stan dard type—for economy and long li we suggest the Superdyne type whic will be operating well within their capa city. In fact, two of these should jus about see the A battery out in hours o running.

The C battery is just an ordinar light-duty type obtainable everywher with a voltage of 9 volts to be had fo the asking.

# R.C.S NEW 1939 TROLITUL COILS

## *SPECIFIED AND RECOMMENDED IN THIS ISSUE*

### THE SKY HOUND SIX

The R.C.S. Kit for this new set comprises our new 1939 type Trolitul High Q Coils and Intermediates. The coils which contain necessary B/C and S/W trimmers, together with 3 section wave change switch and padder, are mounted on a rigid steel bracket. The I.F.'s are iron core for better quality, selectivity, and stability under all conditions. SKY HOUND D/W COIL UNIT CAT. No. K100. RETAIL PRICE .. £3/3/-

SPECIAL IRON I.F.'S FOR K100 RETAIL PRICE, each 10/6

### R.C.S. TROLITUL TUNING COILS

R.C.S. new Trolitul Tuning Coils are highest Q yet produced. Being wound on and supported by a combined Trolitul former and base, they lend themselves to an accuracy and precision hitherto unobtainable, resulting in highest efficiency ever obtained. All coils are suitable for standard type valves.

### THE 2 J.U. SUPER SIX

SPECIFY THE NEW R.C.S. MC TYPE MIDGET CONDENSER. They are easy to gang. R.C.S. have designed a new Trolitul Beat Frequency Oscillator Coil to suit this receiver. Highest Q Coil made. Cat. No. F96. RETAIL PRICE .. .. .. 11/9

### LITTLE JIM TUNING COIL

Specially designed for and used in this set. Extremely high gain and selective.

"Little Jim's" tuning Coil, Cat. No. K80. RETAIL PRICE, 3/6, Post Paid.

"Little Jim's" R.F. Choke, Cat. No. RF2. RETAIL PRICE, 9d, Post Paid.

"Little Jim's" Filament Transformer, Cat. No. TP3. RETAIL PRICE, 10/6, Post Paid.

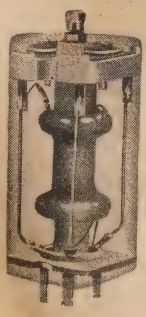
"Little Jim's" Midget Condenser. Cat. No. CV40. RETAIL PRICE, 5/3.

### DUAL WAVE COILS

B/C 1500 to 550 K.C. S.W. 16 to 50 metres.
Air Core Aerial Coil, 460 K.C. Cat. No. G19. Retail Price, 12/6.
Air Core, R.F. Coil, 460 K.C. Cat. No. G20. Retail Price, 12/6.
Air Core Oscillator Coil, 460 K.C. Cat. No. G21. Retail Price, 12/6.

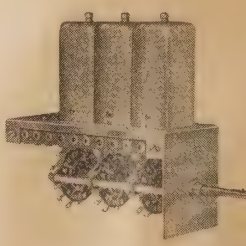
### BROADCAST COILS

Air Core Aerial Coils, 460 K.C. Cat. No. E282. Retail Price, 5/9 ea.
Air Core R.F. Coils, 460 K.C. Cat. No. E283. Retail Price, 5/9 ea.
Air Core Oscillator Coils. 460 K.C. Cat. No. E284. Retail Price, 5/9 ea.
Iron Core Aerial Coil, 460 K.C. Cat. No. E287. Retail Price, 7/- ea.
Iron Core R.F. Coils, 460 K.C. Cat. No. E288. Retail Price, 7/- ea.
Iron Core Oscillator Coil, 460 K.C. Cat. No. 289. Retail Price, 7/- ea.
Permeability Tuned Aerial Coil, 460 K.C. Cat. No. E279. Retail Price, 7/6 ea.
Permeability Tuned R.F. Coil, 460 K.C. Cat. No. E280. Retail Price, 7/6 ea.
Permeability Tuned Oscillator Coil, 460 K.C. Cat. No. E281. Retail Price, 7/6 ea.



### TROLITUL INTERMEDIATE TRANSFORMERS

The new R.C.S. Trolitul I.F.'s are extremely stable, due to new method of construction, made possible by the use of Trolitul formers and base. No loose wires to shift and alter frequency. Positively the best I.F.'s yet produced.
Air Core, 1st, 460 K.C., sq. can, 3in. x 1¾in. Cat. No. IF107. Retail Price, 5/9.
Air Core, 2nd, 460 K.C., sq. can, 3in. x 1¾in. Cat. No. IF108. Retail Price, 5/9.
Iron Core, 1st, 460 K.C., sq. can, 3in. x 1¾in. Cat. No. IF109. Retail Price, 10/6.
Iron Core, 2nd, 460 K.C., sq. can, 3in. x 1¾in. Cat. No. IF110. Retail Price, 10/6.

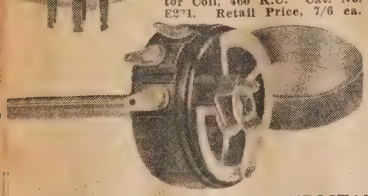


### DUAL WAVE UNIT

B/C 1500 to 550 K.C. S/W 16 to 50 Metres.

Aerial, R.F., and Oscillator 460KC A.C. Cat. No. DW24. Retail Price, £3/3/-.

Aerial, R.F., and Oscillator 460KC battery Cat. No. DW25. Retail Price, £3/3/-.

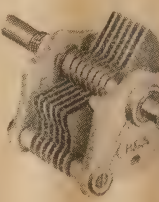


### TROLITUL MIDGET CONDENSERS

R.C.S. Midget Condensers are made in two types, using Trolitul supports, thus guaranteeing practically no loss. The 14 plate equals old style 23 plate capacity. The M.C. type may be ganged.

STAR AND M.C. MIDGETS.

| Max. mmfds. | Cap. mmfds. | Min. Plates. | Cap. STAR. Cat. No. | Price. | M.C. Cat. No. | Retail Price. |
|---|---|---|---|---|---|---|
| 10 | 3 | 2 | CV34 | 3/- | CV41 | 6/- |
| 15 | 3 | 3 | CV35 | 3/3 | CV42 | 6/6 |
| 25 | 3.5 | 4 | CV36 | 3/6 | CV43 | 7/- |
| 35 | 4 | 5 | CV37 | 3/9 | CV44 | 7/6 |
| 50 | 4 | 7 | CV38 | 4/3 | CV45 | 8/- |
| 70 | 5 | 9 | CV39 | 4/9 | CV46 | 8/6 |
| 100 | 6 | 11 | CV40 | 5/3 | CV47 | 9/- |



### POTENTIOMETERS AND RHEOSTATS

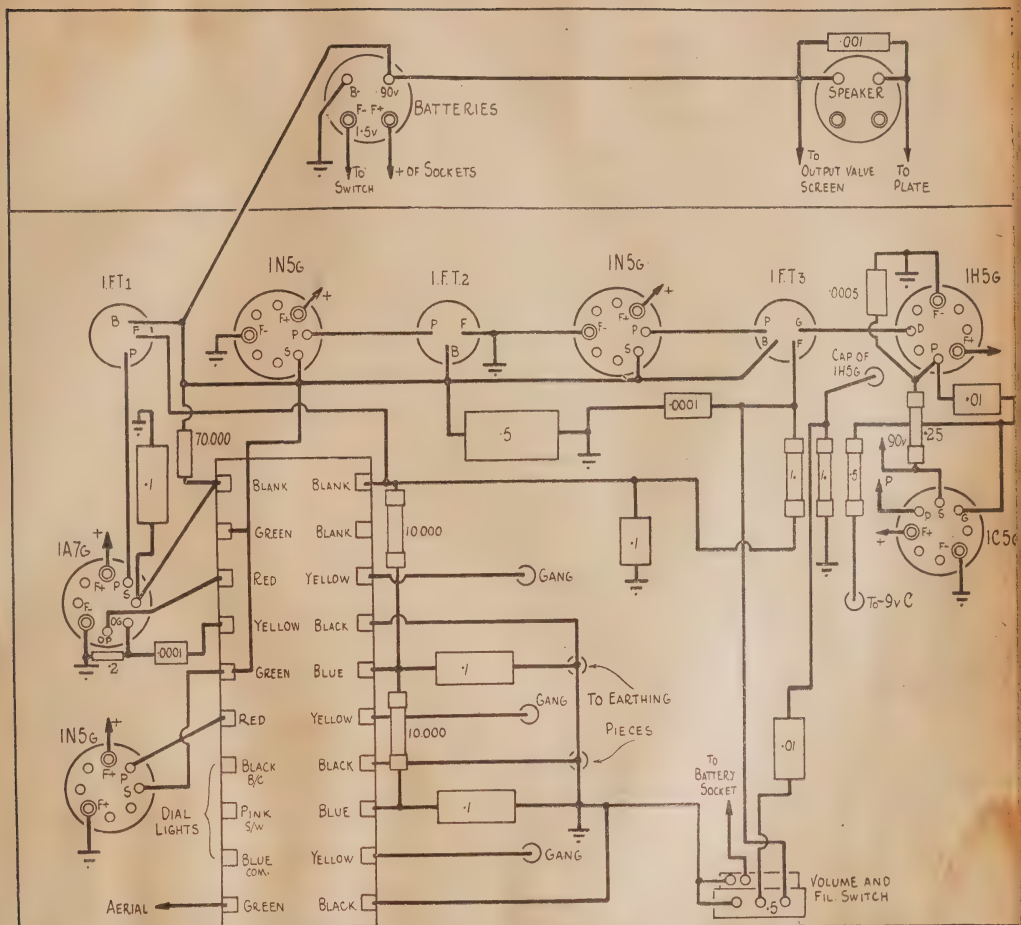
The R.C.S. volume controls are the result of improved and new methods of manufacture together with alterations in design and final testing. Noiseless, they are constructed so as to cut off all volume.

| | | | | | |
|---|---|---|---|---|---|
| 6 | ohm Rheostat | .25 amp | Cat. No. | PT40 | .. 4/6 |
| 10 | ,, ,, | .25 amp | ,, ,, | PT38 | .. 4/6 |
| 20 | ,, ,, | .25 amp | ,, ,, | PT39 | .. 4/6 |
| 30 | ,, ,, | .25 amp | ,, ,, | PT34 | .. 4/6 |
| 400 | ,, Potentiometer | 50 M/A | ,, ,, | PT46 | .. 4/6 |
| 1000 | ,, ,, | 35 M/A | ,, ,, | PT47 | .. 4/6 |
| 2500 | ,, ,, | 30 M/A | ,, ,, | PT49 | .. 4/6 |
| 5000 | ,, ,, | 30 M/A | ,, ,, | PT51 | .. 4/6 |
| 10000 | ,, ,, | 20 M/A | ,, ,, | PT52 | .. 4/6 |
| 15000 | ,, ,, | 20 M/A | ,, ,, | PT53 | .. 5/9 |
| 20000 | ,, ,, | 15 M/A | ,, ,, | PT54 | .. 6/- |

Obtainable from your local dealer, or write direct to

# R.C.S. RADIO PTY., LTD.

50 GLEBE STREET, GLEBE. 'Phone, MW2405




*Here is the wiring diagram, which shows the actual connections for the set.*

## OPERATION

Putting the set into operation is quite a simple matter. A great help here is a dial calibrated for the coils you are using. There are plenty of these, and if you use one, it can assist you materially in lining up.

Having made sure all your connections are correct, connect up the A battery, turn the set on, and in a shaded light, look carefully at the output valve. You should be able to see its filament glowing very dimly. If not, switch off, and see where you have gone wrong. Once having made sure the filaments are alight, naturally, you can't connect the leads already connected to the B battery, and blow the filaments to pieces!

Now hitch up the B batteries (with the speaker plugged in), and tune over the broadcast band. As the coils have been roughly lined at the factory, you are sure to hear something or other. Try to get a station near the bottom end of the dial—say, 2SM, and by adjusting the oscillator trimmer for D/C band, steer it until it comes in opposite its dial marking.

Now adjust the other two trimmers until you get this station at its full strength.

Swing your dial to the top end of the band, and find another station here. Don't touch the trimmers on the coil, but, with a small screwdriver, adjust the padding condenser until this station comes opposite its right mark on the dial. This should also be the spot at which it is heard most strongly.

If it isn't, the dial may be out slightly, or you may have it screwed up on the condenser shaft with the condenser plates too far in, or out, of mesh to start with. This is a point which many overlook, but it's worth investigating and experimenting with, if at no point can you get all the stations to hit very closely to their proper markings.

Assuming that all is well, go back to the bottom of the dial, and check on the trimmers once more. Maybe a little touch will be required to peak them on the nose. For finest adjustment, tune almost to the bottom of the dial, and work either on a fa station or just the noise level of set, for most volume.

Then, and only then, it is permissi to run over the intermediate trimm for a very careful check-up. Mark w a pencil line the original position of screw slot, so that you can come b to it if you require to do so. Th will peak very sharply, so be care over this. Possibly you can bring gain up quite a bit by the slightest justment one way or the other.

But don't start screwing them up over the place. Once they are all of line, your only course would be send them back to the factory for alignment. Not more than about or eighth of a turn should be needed.

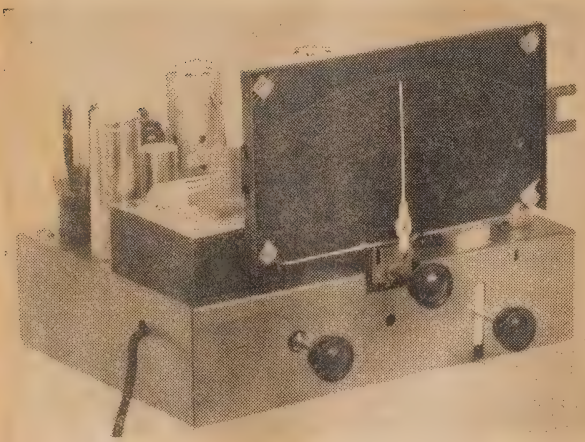
The parts we used in the original, reference, were—Dial Efco, coils R.C resistors I.R.C., condensers T.C speaker Rola, batteries Ever-Ready, ga condenser, Stromberg, valves Brimar,

# The SKY-HOUND SIX

## DUAL-WAVE RECEIVER

By A. G. HULL

**Here is the description of a receiver designed to include the best features of modern receiver design. The circuit is standard, the coils are new types wound on Trolitul, and the whole receiver is thoroughly efficient and reliable.**



*front view of the Sky-Hound. Any suitable type of tuning dial may be used—specify it to match the coils.*

DURING the past three or four years there have been few startling changes in circuit design, but keen attention to detail has resulted in vastly improved performance.

Here is a typical circuit representing all that is considered advisable by present-day technicians. It might be taken as fairly representative of the type of circuit being used for a large number of the better-class receivers for 1939.

I can recommend it as thoroughly reliable and serviceable in every way, and yet so efficient that it is impossible to imagine any way of getting greater range, selectivity or power from any alternative way of using six normal valves.

### THE CIRCUIT

At a glance, the circuit appears quite normal, but closer study will reveal several minor points where attention has been paid to detail with good results. This is especially noticeable in the audio end, where a simple form of inverse feedback allows us to obtain "triode" type of quality reproduction, but with the sensitivity and power output of the beam power valve used.

Isolation of the audio end is obtained by using the diodes of the intermediate valve for detection, so that only audio signals are handled by the two valves which comprise the audio amplifier.

### COMPONENTS

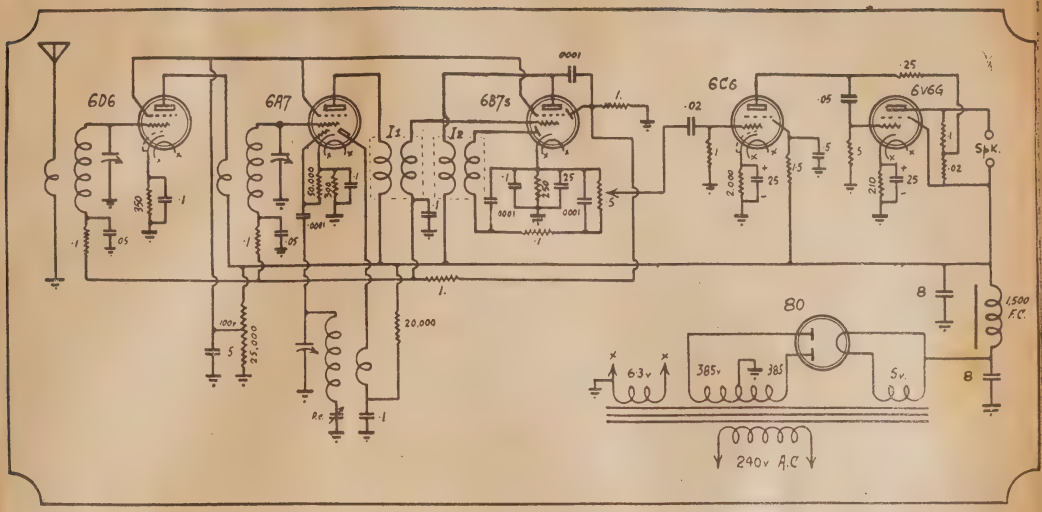
Vastly improved results were obtained with this receiver, compared to those obtained with a similar type of set handled in 1936. This was not entirely due to the circuit, and most of the credit must go to the improved components used, especially the coils and intermediate transformers. In all cases the coils are wound on Trolitul formers, avoiding some of the r.f. losses which occurred with some of the older types of insulation materials.

### RESERVE POWER

Of course, at any time, an efficient superhet with an r.f. stage, as well as an intermediate stage, can be depended to have as much sensitivity as can be handled under normal operating conditions, but the reserve of power is nice to have, especially on the short-waves, where often enough a truly sensitive receiver will play the weak stations without excessive noise from the receiver itself, giving far greater effective sensitivity than is usual with a smaller receiver, which is working "flat-out" all the time.

### PARTS LIST

1 Base, size 8 x 14 x 3.
1 Dual-wave coil box.
1-3 Gang condenser to suit.
1 Dial to suit gang.
2 Intermediate transformers.
1 Power transformer, 100 ma., 6.3v. type.
2 20,000 ohm 1 watt resistors.
1 50,000 ditto.
4 100,000 ditto.
1 250,000 ditto.
1 500,000 ditto.
3 1 megohm ditto.
1 1½ megohm ditto.
1 200 ohm wire-wound resistor, 100 ma.
1 250 ditto, 30 ma.
2 300 ditto.
1 2000 ditto.
1 Voltage divider, 25,000 ohms.
1 500,000 ohm volume control.
4 .0001 mfd. mica condensers.
1 .02 mfd. tubular condenser.
4 .05 ditto.
4 .1 ditto.
1 .25 ditto.
1 .5 ditto.
2 8 mfd. 500v. electrolytics.
3 25 mfd. electrolytics, 40v.
Valves—1 6U7G (6D6).
1 6K8G (6A7).
1 6G8G (6B7S).
1 6J7G (6C6).
1 6V6G.
1 5Y3 (80).
Sockets to suit—4 valve shields.
Speaker—1500 ohms field, 5000 ohms load.
Sundry hardware, screws, wire, etc.




*In this circuit, nothing has been omitted which will achieve the finest efficiency.*

## THE COST

I haven't worked out exactly what this set would cost to build, but from a glance at the invoices for the parts which I bought it is very obvious that many smaller parts have come down in price a lot since the good old days of 1929. In that ten-year period it seems that resistors and condensers have dropped about 75 per cent.

Compared to ruling prices for the better class of dual-wave superhets with an r.f. stage, the cost of a kit of parts is also most encouraging. Some people seem to have an idea that it's just as cheap to buy a set as build one, but it certainly doesn't apply in the case of a receiver of this type.

I didn't start out to draw comparisons between home-made and factory-made sets, but while on the subject I might mention that the actual components specified by me for this set are exactly the same as those used by prominent set manufacturers, and there is no reason why your home-built set should not give exactly the same performance as its factory-built twin. As a matter of fact, the extra handiwork which you put into your set should mean even better results.

## CONSTRUCTION

The actual job of building up a set of this kind is not difficult, but at the same time I wouldn't advise a novice to start out with something quite so ambitious.

Not having built a set for months, I found the task a little slower than I expected, but even so, the time taken on the job was only about four hours. Anybody who has had a bit of set-building experience could expect to do the complete job over a wet week-end.

## THE PARTS

Work on the job is helped by the ready-cut bases, which are readily available. With all the holes cut and ready to take the components the whole of the assembly job is simply a matter of meccano-style assembly. Personally I like to fit the power transformer and sockets first and wire up the heaters of the valves. In the original, I ran the lot of the valves, except the rectifier, from a single 6.3 volt filament winding. It was just a matter of running the twisted pair along from socket to socket.

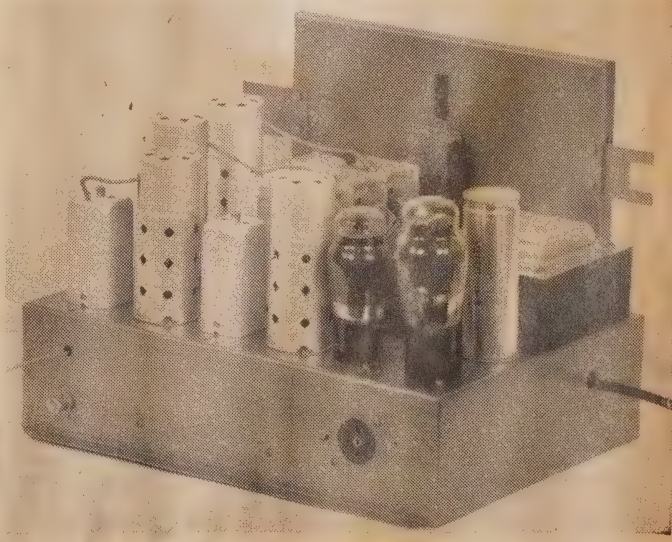
Then I wired the rectifier socket with its filament supply and the a.c. input, and on from the filament side to the first electrolytic and the speaker socket.

After all the sockets have been wired the coils and intermediates are mounted and wired, and leads brought out ready for the component strips as shown in the picture diagram.

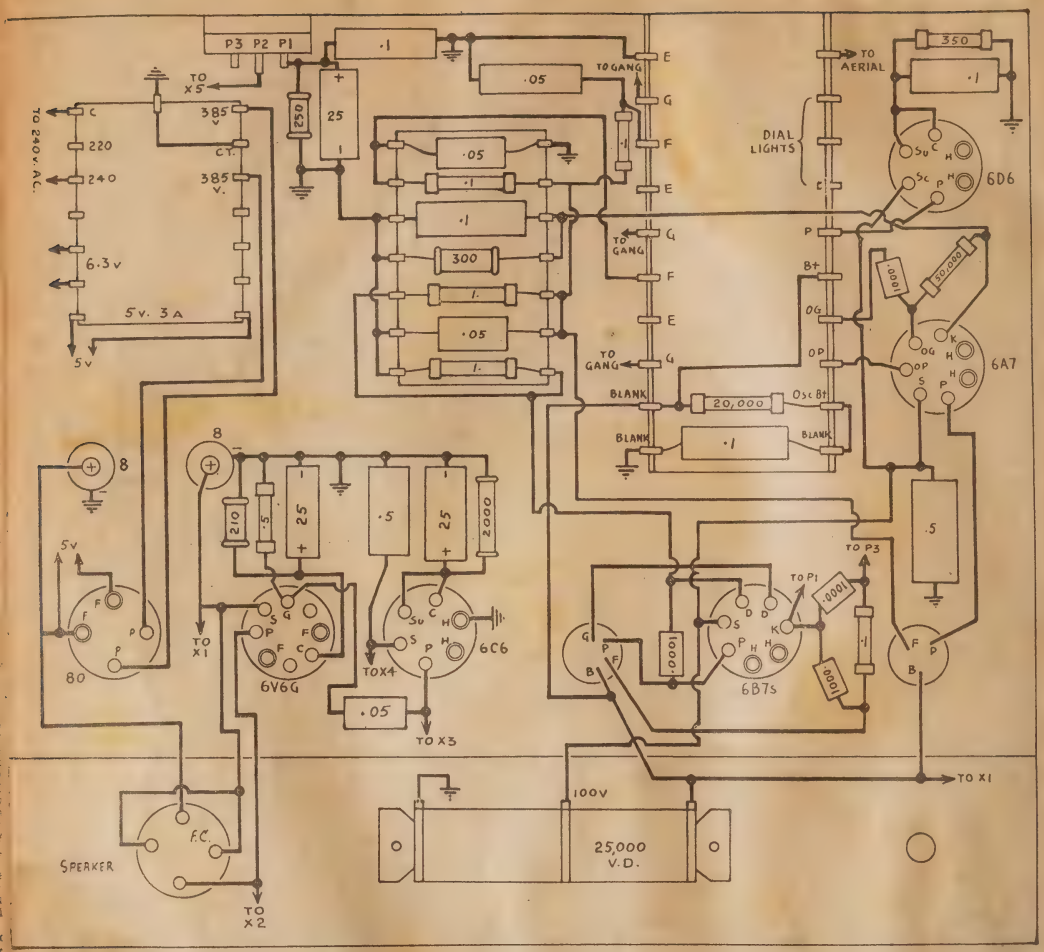
Before mounting, the strips are fitted out with the components as shown in the diagrams, and only a certain amount of care is necessary to make this method of mounting a vast improvement over the old idea of letting the bits hang on to their terminals.

## WARNING

There is a point to be watched carefully in connection with the use of Trolitul, and that is in connection with



*A clean, neat layout is responsible for this workmanlike rear view.*




*Keep this wiring diagram before you when making the set. Don't forget the little panel shown below.*

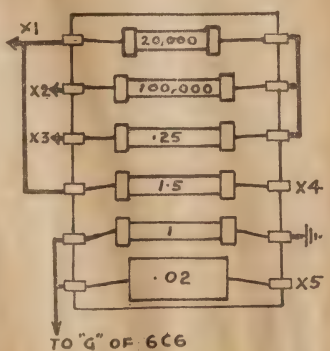
ts melting point, which is fairly low. For example, the terminals of the intermediate transformers come through he Trolitol base, and if you heat up he terminals too much the base will often. If you then push at the terminal, you may move it about. No harm will be done by actually melting the insulating compound, and it will set ack in its normal state as soon as ool. But is possible to conceive that areless use of both heat and pressure night result in a broken connection n the inside of the terminal. It is only remote possibility, but it is mentioned or safety's sake.

## OINTS TO WATCH

Make sure that the negative (black) ide of the electrolytic by-pass condeners go to earth in every case.

Make sure that the cans of the electrolytic filter condensers are effectively arthed to the base.

Connect up all earth terminals with a run of bare wire. Even if it doesn't look nice, it's a great help to efficiency, especially on short-waves.




*Connections for the little sub-panel.*

Make sure that the 240-volt power supply wires are effectively soldered to the terminals of the power transformer. Live 240-volt leads are dangerous if they come adrift. Put a knot in the cord so that any pull won't be taken by the terminals and put a rubber bush in the hole through the chassis so the power cord won't get frayed.

Use 1-watt resistors for all grid-leaks, even if they don't have to handle this amount of power. They are quite cheap.

## ALIGNMENT

Dual-wave receivers appear to be easier to build and easier to get into operation than old-style broadcast sets. Apparently the coil people take greater care with the assembly and testing of the dual-wave coil units. The last three sets built with dual-wave coil boxes have all gone straight into operation as soon as they were finished, and without any adjustment of trimmers or pad-

der they have played quite successfully. In one case, no further adjustment was required, even for peak performance, while with the other two adjustments amounted to only a fraction of a turn on a couple of trimmers. It will be most surprising if the set fails to play all the local broadcasting stations quite readily as soon as it is properly wired up. Then a touch of the screwdriver on the trimmers will soon tell you whether you can improve things by realignment.

## ALIGNMENT STEP-BY-STEP

Actually the initial testing and alignment of the set, once you have made sure that it is wired right and operating, is to fit the dial so that the gang condenser is fully meshed when the dial pointer is right over at the far end of the dial beyond the 500k.c. mark.

Using an aerial consisting of two or three feet of wire, and with the volume control fully advanced, you then swing the dial to some station down around 2UW, and it should come up on the spot indicated by the dial, if the dial is calibrated to suit the coils and tuning condenser used.

At any rate, swing the dial to and fro over this station, at the same time trying an eighth of a turn one way and then the other on the oscillator trimmer (broadcast). If a fraction of a turn in one direction gives better results, try another fraction; but don't on any account start turning this trimmer with turns at a time or the whole alignment may be lost.

Once having found a peak position on the oscillator trimmer from which any variation of adjustment means a loss of volume, you can next adjust the r.f. stage trimmer for best results and then the aerial trimmer in the same way. When adjusting the aerial and r.f. trimmers, keep the dial tuned to the station exactly as it was set when the oscillator trimmer was adjusted.

## THE PADDER

Next swing the dial to the top end of the dial, somewhere about 2FC, and get a station there, and rock the dial to and fro over the station while adjusting the padder for maximum results. This adjustment will not be anywhere near as critical as the adjustment of the oscillator trimmer, but don't rush the job. Try half or a quarter of a turn at a time, then rock the dial and be quite sure whether volume is up or down. If down, go back half a turn and try again in the other direction.

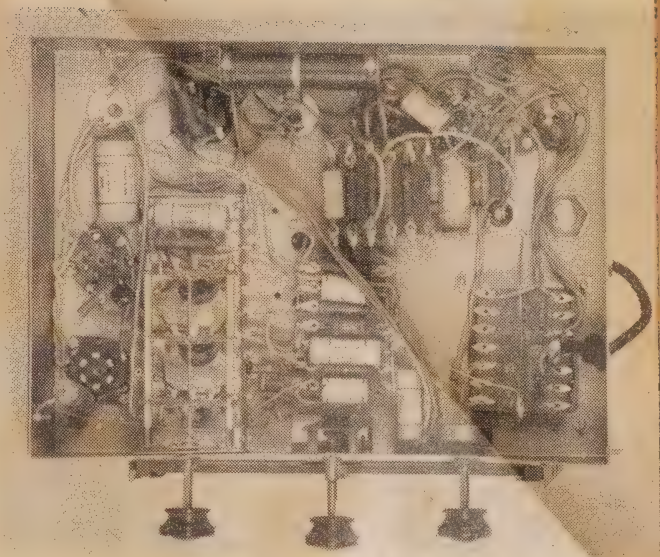
## THE INTERMEDIATES

When convinced that the r.f. end of the set is properly adjusted, a fraction of a turn might be tried on each of the intermediate trimmers, working on each trimmer individually until a peak position has been found. Trimmers on the first intermediate are far more critical than those on the second, and if this is noticed it is not to be worried about.

## SAFETY FIRST

Don't take risks with electricity.

If you are not quite sure—don't do it. Get advice first.



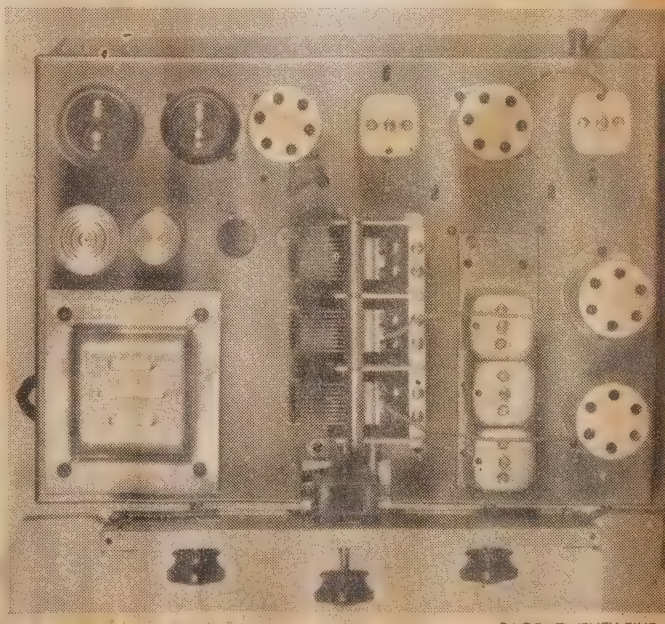
UNDER THE CHASSIS

*The sub-panel method of assembly is clearly illustrated in this picture. Owing to the design of the coil unit, connections to it are very short and convenient to make.*

☆ ★ ☆

ABOVE THE CHASSIS

*From this picture you will get an idea of the layout. Note the grid leads running across the coils to the gang. Performance does not appear to suffer because of these leads being a little longer than usual.*

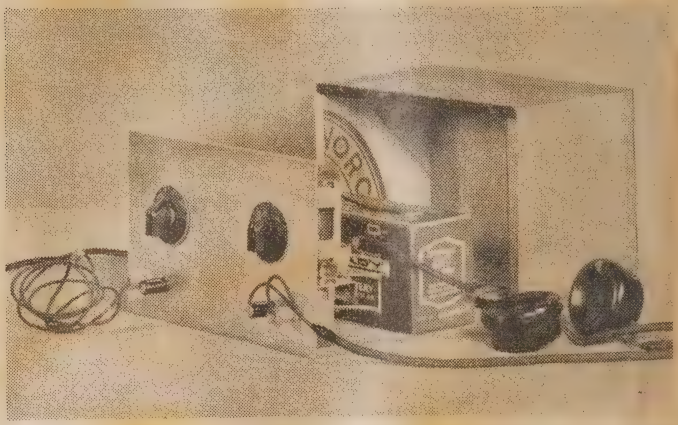


*By request*

# LITTLE JIM

## *our most popular set*

**An ideal, self-contained, compact receiver for use by the side of your bed, or anywhere else where good head-phone reception of local stations is required. It is simple, reliable, and fool-proof.**



*This picture gives an excellent idea of how Little Jim fits together. The chassis fits tight against the battery, which is hard up against the back of the cabinet.*

So popular was the issue containing a description of Little Jim, which was on the streets shortly before the first Test Match, that we are forced to reprint the circuit and details for the convenience of many readers still asking us for them. There must be hundreds and hundreds of these receivers in operation, because we know for a fact that within a few days of the article being published, it was almost impossible to buy a single gang condenser in the city!

However, the circuit and wiring diagram given here should enable anyone to build it for themselves. As the photograph on this page so clearly displays, we built the cabinet from sections of an old butter box, which was then given a coat of grey duco, with a black band along the top and bottom edges of the panel. If you are very particular, you can get a cabinet specially built—leatherette covering is very suitable for this purpose, as it looks very well, and wears excellently. We don't particularly advise you to use a polished cabinet for a receiver so likely to find itself in all kinds of places. It scratches too easily.

### ONE IN TWO

Little Jim is a one-valve set using a 6A6 valve as both regenerative detector and audio amplifier. It does this because the 6A6 is a twin valve, having two triodes in one envelope. So that your set, although using only the single valve, gives practically a two-valve result.

The receiver is built on a very small chassis, only a couple of inches deep, and having a front panel of 7 inches by 9½ inches. The depth is enough to allow for the tuning condenser and reaction condenser to fit in within its clearance, and as there are very few other components, there is no difficulty in fitting them mostly under the base. The chassis we used was made of aluminium, and similar chassis ready cut are obtainable now at most radio stores.

The idea of the receiver is to operate a pair of headphones with sufficient strength to allow really good reception of local stations, using a small aerial, which can be the wire mattress of the bed, if desired. The set itself stands on a bedside table, and the phones are placed under the pillow. There is enough volume to hear any local station quite clearly without disturbing any other member of the household, and the two headphones which comprise the set may be placed one under each pillow, if two people want to listen in at the same time.

The net result is a particularly convenient and comfortable way of hearing cricket descriptions, or any other programmes, for that matter.

The consumption of the set is so low that it may be left on all night if desired, without involving any noteworthy expense. The valve itself consumes only a few watts of electricity, much less than even a small lamp, and the drain on the B battery used for high tension is only about 1 milliamp.

The filament of the valve is lit from a small transformer giving 6 volts at about

## WHAT IS YOUR IDEA FOR A SMALL SET?

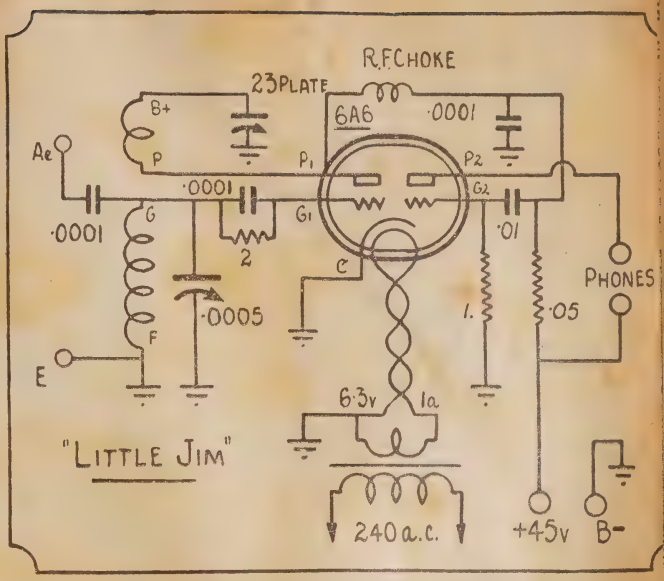
Little Jim is our idea of the most useful and practical small receiver. Have you got a better one? If you have, we would be pleased to use it for the basis of a technical article in our paper. Send us a copy of the circuit and a short description of the set, so that we can see for ourselves whether you have beaten us in the search for the small and simple. It may be that you have found improvements on the receiver as it stands. Your suggestions on this point will be welcomed. Next month, we hope to describe a "Little Jim" built for operation entirely from batteries.

## PARTS LIST

**LITTLE JIM**

Panel, 9½in. x 6¾in.
Sub-panel, 8½in. x 2in. } See text.

1 Tuning coil—see text.
1 Tuning condenser up to .0005.
1 23-plate midget condenser.
1 6A6 valve.
1 Filament transformer, 6.3 volts.
1 7-pin socket for 6A6.
1 2 meg. resistor.
1 1 meg. resistor.
1 50,000 ohms resistor.
2 .0001 mica condensers.
1 .01 tubular condenser.
1 R.F. choke.
4 Terminals.
1 45-volt B battery, light duty.
1 Pair headphones.
One doz. nuts and bolts, 6 solder lugs.
5 feet of hook-up wire, power flex and plug.
2 Knobs or dials, insulated solder lug.
Cabinet as desired.




*Here is the circuit of the set. Only a dozen components to worry about!*

1 amp. We used a transformer because it is much more satisfactory than batteries, and would cost no more than batteries of sufficient size to run the valve for a respectable period with satisfaction. Further, there is no danger of the batteries dying out at the wrong moment, as they often have a habit of doing.

Our photograph shows that we housed the complete set with the 45-volt light duty B battery in a small cabinet made out of a butter-box. The battery measures 8½ x 2¾ inches looking at it from the top, which would make the side mea urements of the cabinet about 5 x inches, to preserve a good fit, and pr

rent the battery from moving about. Not that it could do any harm if it lid.

All the components used are standard. The tuning condenser may be anything from .00035 to .0005 mfds., and the reaction condenser is a 23-plate midget. The components under the chassis should be obtained in as small sizes as possible—the mica condensers, for instance, can be the "postage stamp" type, and the resistors all ½-watt types. It is easier to work in small components than large ones.

The tuning coil was specially made for this set by R.C.S., and connections to it are made by means of the solder lugs mounted on the former itself. One of these is connected to the chassis—the "F" or grid return lead—and if this connection is made to a solder lug, it will make the coil self-supporting. The

The original Little Jim has been in constant use since it was first built nearly a year ago. It still has the same B battery as when new, and it still gives the same satisfaction as it did when first built. When this battery is exhausted, it will mean about 9s for a new one. This represents the entire running costs of the set for that period. One could scarcely wish for better economy than this and as long as you don't leave it running every night and every day, there is no reason why you should not get the same results from your copy of it.

remaining connections are made to the other lugs, which are color coded.

The aerial connection is made through the .0001 mica condenser. Since the original set was described, we have found some getting best results by using a .00005 condenser here, as we suggested at the time. Some may not be able to tune over the full broadcast band with the bigger condenser, particularly if the aerial is too big.

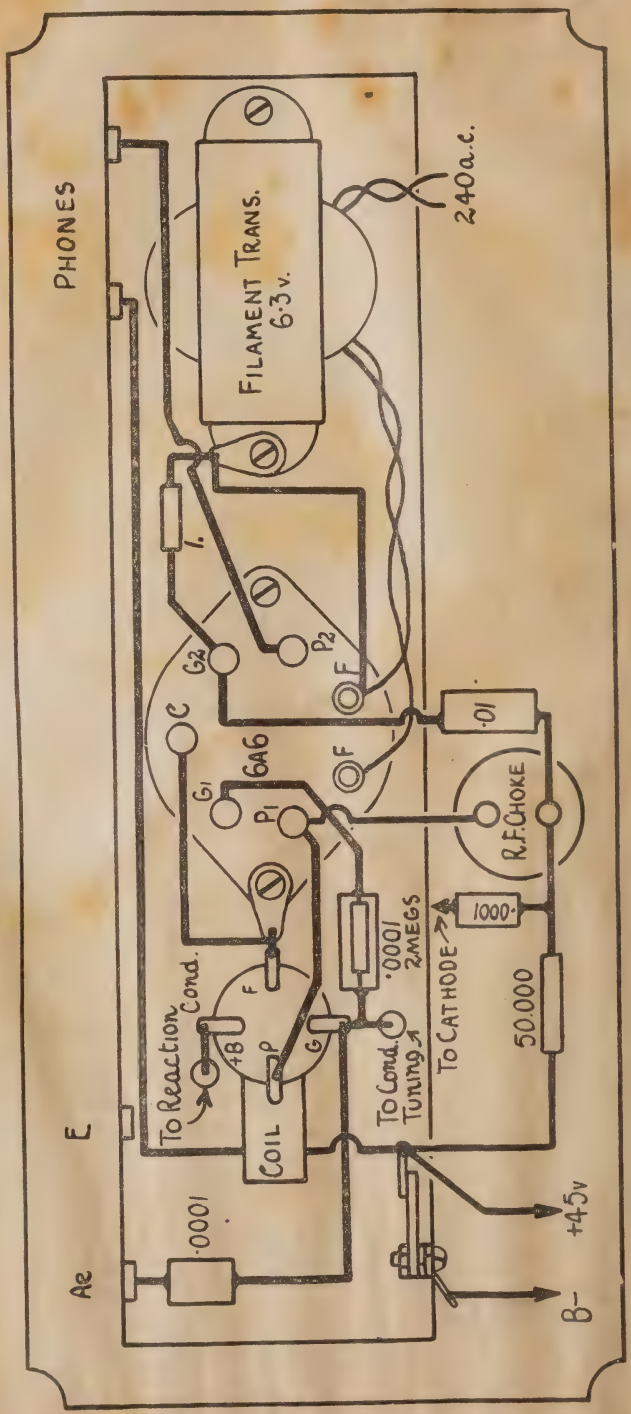
## THE AERIAL

The set should not be operated with a big outside aerial. Being of a modest nature, it is not able to separate all the local stations if fed with a big aerial. If you use the mattress of the bed, or about 12 feet of wire, there should be no trouble in getting plenty of volume from practically all the locals, and with complete separation except when operated close to some powerful station.

We have consistently used the mattress as an aerial with the original Little Jim, and have no trouble in getting plenty of punch and adequate selectivity.

*Left: The wiring diagram. Don't forget to insulate the joins between the transformer A.C. leads and the length of power flex.*

## Actual Size Wiring Diagram



By V. A. BENNETT (VK2VA)

# HOW ARE THE BANDS

## FREAK CONDITIONS PREVAIL

PREVAILING conditions are such that it is difficult to know just what is likely to happen next, and most amateurs feel that Old Man Ionosphere owes us an apology for his capriciousness of the past month. This has been most noticeable on the 14 megacycle band, where, like Micawber, most of us have spent our time "waiting for something to turn up."

On the higher frequencies present conditions seem to show that the gradual decline of radio activity, predicted by W6CUH, which, he declares, will reach its lowest ebb in 1940-41, has already begun. Undoubtedly freakish conditions now exist—one night the ether being devoid of any semblance of good DX, the next night providing excellent opportunities for the watchful DXer.

### 20 METRES

Conditions on 20 have been very topsy-turvy of late, and during this month we can expect them to remain so. The absence of R9 American phone signals is most noticeable. During this period last year such signals were very consistent. It will be well into the winter before we are enjoying 100 per cent. contacts with lads in the States. The band is fair during the afternoon for W's, but they do not last long before they have to compete with the K6 stations, when the skip shortens. They can be heard late in the evening and until the early hours make spasmodic appearances.

Europeans can be worked on CW from 15.00 till the morning. They are not prolific, but such stations as ES5D, G8IW, SM3MT, LA5B, F8PZ, and EI4J are very consistent.

A peculiarity of 20 metres at present is that while on some evenings practically nothing can be heard, on others, by exercising a little patience, it is possible to work all continents on CW between the hours of 20.00 and 24.00. Asiatic stations, XU's, VU's, and J's are plentiful.

At present there are two J8's (Korea) operating on the high frequency end of the band, and, as Korea is a separate country, they make interesting contacts. The number of XU's is increasing, and during the QsO they never fail to give their box number for QSL.

LU6DG on 14,400 on CW, CE1AH on 14.040 phone, and PY1GE on 14,390, CW, are there for the asking. I anticipate little change on this band for some time, though possibly a slight improvement between this country and America can be expected.

# GOOD HUNTING ON 40 METRES

## EUROPEANS IN MORNINGS

Forty metres is the band showing increasing improvement, and if one's receiver is selective enough to sort out the many local phone signals an abundance of good DX stations can be heard and worked. It is only after operating on 40 metres that one realises the rapid growth of amateur radio throughout Australia. The large number of three-letter VK2 calls testifies to the number of amateurs obtaining their licences in New South Wales in the past few years. Most marked on this band is the consistency of American signals which may be heard late in the afternoon and evening.

European stations are coming through in the mornings. March-April should be a very active period for DX on this band. During this period last year W's could be worked at any hour of the evening on 20 metres, but the reverse is the case now, and I would suggest that anyone desiring consistent contact with America would be advised to use 40 metres. Unfortunately there is no American phone on 40 metres, but many interesting rag-chews can be had via the key.

Asian stations are also very active on 40, and will continue so during the coming months. An occasional South American can be heard during the early evening, and there is no reason why those aspiring to the DX Century Club should not add extra countries to their list on this band. After operating on higher frequencies 40 metres seems a strange world, and it takes a few nights to become accustomed to it. Possibly one reason why more amateurs do not change more frequently to this band is the aerial—there are still many half and full wave zepps used on 20, and these are often rather unsatisfactory on 40 metres.

This page is intended to give you each month, a guide to conditions as they are at present, and are likely to be during the coming weeks. You can greatly assist us by your letters and reports. Let us know how you are getting on.

# VK-ZL Activities On Eighty Metre

On 80 metres general activity see mainly confined to VK-ZL phone wo Conditions on this band have not alter much over the past few months, a judging by present conditions, there w be little change in the near future. T band is most active after 18.00, wh ZL and interstate stations, phone a CW, are numerous. An occasional W Coast American station can be heard contact with ZL. It would be interes ing to know how, if any, VK's are wor ing W's or Europeans. In a recent iss of QST I note that G6WY has be working VU2AN consistently, and wi a South American contact he will ha completed his WAC on this band. So of the boys who require Zone 21 m find VU2AN on 3620 k.c.'s, as well as 20 metres. For examples of efficie duplex and break-in operation 80 tak the prize. It is quite a usual occurren to hear as many as six stations operati together, using break-in. Eavesdroppe should find 80 metres very satisfying their curiosity, as reticences and inhib tions have little place in the convers tion of operators on this band, conve sation covering any and every subjec domestic or otherwise.

# RADIO CLUBS KEEN ON FIV

Five metres is popular among a nun ber of Sydney amateurs. The Zero Be Radio Club is very keen, and any am teur who is thinking of becoming acti on this band will be welcomed with op arms by members of that club. VK2 and VK2AFQ are both operating cryst control rigs, and expecting at any m ment to make an overseas contact. U to the present no reports have been r ceived from overseas of five-metre si nals having been heard from this cou try. This is not due to lack of enthus asm on the part of VK amateurs, many well-known men are transmitti during scheduled periods. It is doubtf if the hopes of enthusiasts on this ban will be fulfilled, so far as DX is co cerned.

* * *

### THINGS STABLE ON 10

On 10 metres conditions can be ant cipated almost to the minute. At fir a few weak signals may be heard, ar then in a short time the band is ope for American phone and CW, K6, and few South Americans. These seem to l the extent of the DX to be worked. Th band opens from 01.00 to 12.00, and the from 16.00 to 17.00. One feels a litt pessimistic about 10 metres, and report from overseas are not at all favorable.

* * *

### NOT MUCH USED

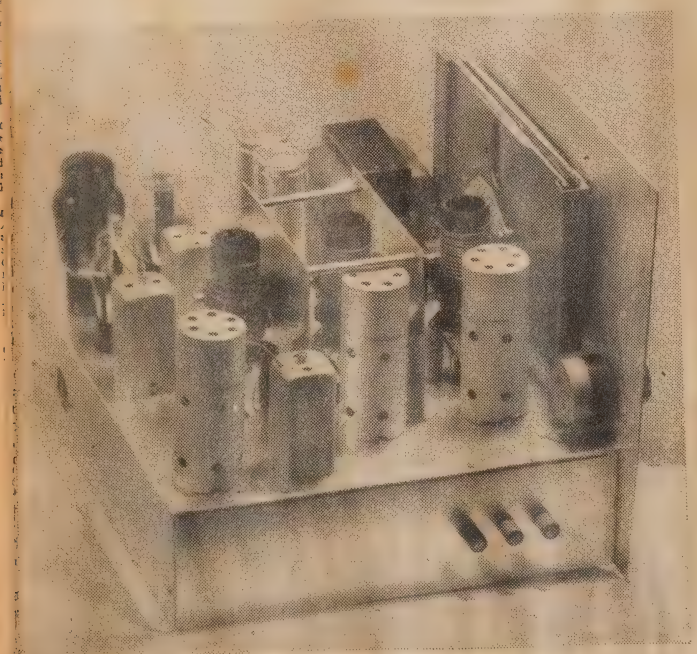
As regards 160 metres, during a re cent 20 metres contact with a K6, h mentioned his desire to conduct a VK on 160 metres phone, having alread worked a W on this band. Any inter ested amateurs might keep a lookou for him.

THE FRONT PANEL

*This photograph shows the front panel and the controls. Those across the centre from left to right are: I.F. gain, tuning, and beat oscillator switch. The bottom row (left to right) are: Regeneration, R.F. trimmer, oscillator band-set, detector trimmer, and audio gain control. Note the semi-circular "lanes" marked out on the dial. Our calibrations, being in pencil, didn't register in the block-making.*

A REAR VIEW

*A side view of the set, showing many constructional points. Among them will be seen the I.F. gain potentiometer, connections for doublet antenna, bracing pieces for coil shields, etc.*



# THE

FOR this, the first issue of our paper, we wanted to describe a short-wave set which would represent the design most popular amongst amateur operators and short-wave listeners. In order to find out what was the most popular type of set, we started a few inquiries amongst our technically-minded acquaintances and fellow-amateurs, not forgetting the men whose job it is to sell parts, and came to the conclusion that our set would be a six or seven valve job.

We were a little surprised at first to find that the popular circuit used so many valves, but on further consideration it is fairly obvious that one can't very well do the required job with less.

Some further investigation, and we found that the seven valves were made up as a rule of a converter valve and separate oscillator, one I.F. amplifier, second detector, output valve, rectifier, and separate beat oscillator.

Hullo! we said, something wrong here. Don't deceive yourself—this isn't a real seven-valve set at all. It's a four-valve set, or rather a four section set. An ordinary dual wave receiver of seven valves gives more than this for the money. There is an R.F. stage included, converter, one or more I.F. stages, second detector, output valve, and rectifier. Where have the other two valves gone to?

The answer, of course, is that they have gone firstly in the separate oscillator, and, secondly, in the beat oscillator valve. Two valves which do not contribute to the amplification or selectivity of the receiver.

So we got out the proverbial pencil and paper, and started to get something which would stop the wicked waste of two valuable valves. Our job was to find a way out of the separate oscillator, and the extra valve for the beat note.

## THE CONVERTER SECTION

There's a story attached to all this, so we will tell it as it all worked out. As we started off with the converter, let's treat it first.

Now the average man believes that there is nothing like the separate oscillator. In fact, he considers, for various reasons, that unless a man has a set with a separate oscillator, he may as well go and hide his head in shame as being a cad, or some other low person. Single valve converter circuits may be all right in commercial sets, which only have to be sold for a living, but in our high-performance amateur sets, they are definitely not to be thought of!

Now, we aren't looking for fights, but we are willing to wager that the average amateur receiver, with its separate oscillator, even including the weird and wonderful arrangement of valves sometimes recommended for mixing circuits, is not doing as good a job in the converter circuit as many commercial

# 2JU SPECIAL SIX

## amateur receiver

Here is a receiver specially designed for amateur use, which will give you a genuine eight-valve performance from six. Several constructional and circuit features are included which make it unique, not only in its design, but also in its construction. Such things as a simply hand-calibrated dial will allow you to find your frequency at a glance. Bandspread gives you six or seven inches of scale on each band. The new 6K8G converter and the 6C8G second detector and beat-oscillator save you two valves without efficiency loss. Vernier band-setting allows quick and sure adjustment when changing coils . . . . and can she go!

receivers using a valve such as the 6A8. If you disagree you will have to convince us that you have a better laboratory to check your results than has the best of the commercial labs. in question, and that you have the knowledge and ability to adjust the circuit in your receiver as well as the men in such a laboratory. If you can produce your figures on grid current at various frequencies, conversion gain, noise level ratios and the like, we will humbly apologise.

The fact of the matter is, of course, that we amateurs, who only slap on the number of turns which seems to work out the best, can not hope to compete with a laboratory for such accuracy. So that the majority of our case for using separate oscillators and so on falls to the ground, and rests on such things as a bit better freedom from interlocking, etc., than we can get with a single converter valve.

That's one point to be considered—that it's easier to talk about our efficient separate oscillator circuits than it is to get the efficiency, so's you'd notice much difference.

### THE 6K8G

This brings us to the consideration of a new valve which has lately come to the fore—the 6K8G. This is a converter valve, which has been constructed with a very much improved plan, allowing most of the disadvantages of the older 6A7's and 6A8's to be overcome. It isn't yet a perfect valve, but its's a darned good one. We had hoped to have a series of figures run off for this issue, showing just how it compares with the 6L7 and separate oscillator, and also with its newcomer friend, the 6J8G, because there's so little difference between them, that the amateur constructor is not likely to tell the difference. We will go further than this—having been a very keen user of the 6L7 and every other type of converter we could lay hands on, we'll wager that two identical sets, placed side by side, using the two valves, would, to the amateur ear, sound exactly the same. We just could not tell the difference, and neither could you.

The 6L7 combination was reputed to be quite free from any pulling between oscillator and mixer. As a matter of fact it wasn't free from this fault, which existed to a very small degree, and we haven't used a converter valve that was. There is just a tiny bit of it apparent with the 6K8, but not a skerrick more than with the 6L7. Noise level isn't any higher, sensitivity may be down a trifle, owing to the lower plate resistance, but this isn't important.

### NOT CRITICAL

What is important is that the 6K8 is a valve which, as far as the oscillator characteristics are concerned, isn't a bit critical, and the same cannot be said of all other types. It can't be said of the 6J8G, which, according to laboratory experience, shows a big change in efficiency with a few volts difference in the injection. Its plate resistance is higher than the 6K8G, which may be why some have preferred it. You will remember by the way, that this valve isn't the same as the 6K8G, being actually a 6L7 type, with the oscillator in the same envelope. However, to make the use of this high plate resistance, or should by rights use a high-impedance intermediate transformer, otherwise in practice there isn't much use to it.

Why we like the 6K8G is that the average amateur, who sometimes hasn't facilities for measuring the oscillator grid current, has every chance, if he follows the coil data given, of obtaining optimum working conditions with it without worrying whether it may be a bit above or below the 150 microamperes which is recommended. All the coils detailed here have been worked out to supply a grid current at least equal to this 150 microamperes, and even if this is exceeded by 100 microamperes no harmful results will occur or any noticeable change in sensitivity.

Summing it up, we have proved to our satisfaction that there just isn't anything in this prejudice against the single converter valve such as the 6K8G, and we are quite satisfied that in including it in our circuit we have thrown nothing whatever away. Quite a number of amateurs whose experience demands respect have tried out this receiver for themselves, and they have all remarked on its low noise level and freedom from pulling at maximum gain.

As a matter of fact, the 6K8G is reputed to be slightly regenerative anyhow, about 20 metres, which is just where the average valve tends to drop off. No, sirs, in many ways, the electron-coupled mixer is the ideal valve for converter service, and there are plenty of clever men who share this opinion.

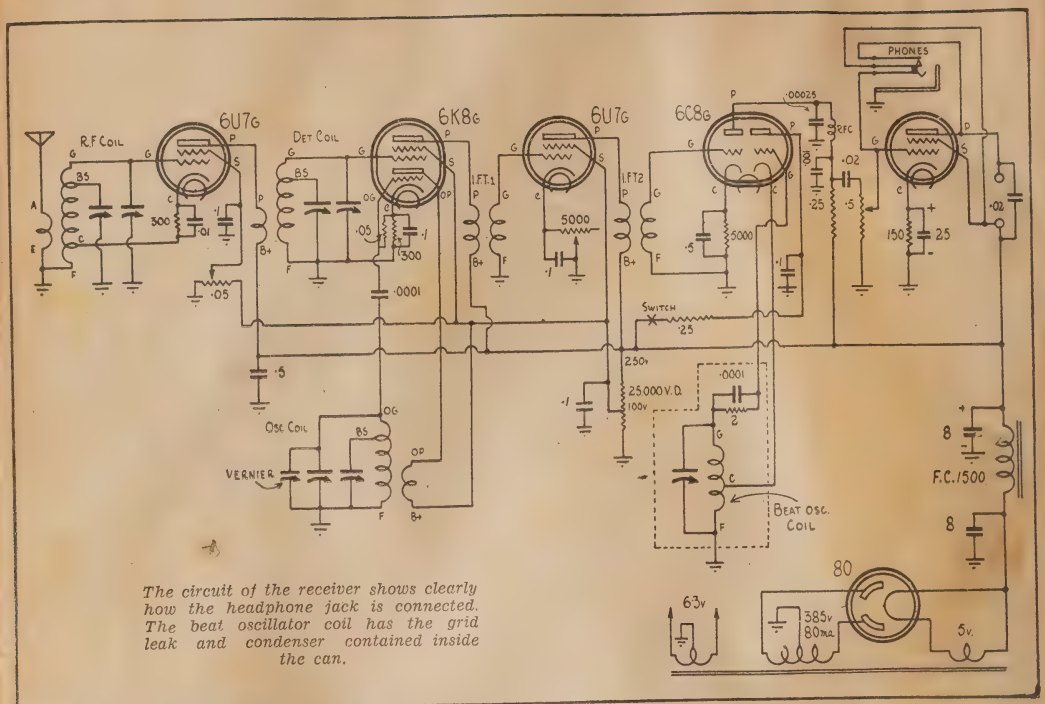
It is scarcely necessary to point out that this valve simplifies the construction of the set quite a bit, and saves the cost of the extra valve.

### THE 6C8G

Turning now to the beat oscillator circuit, we set out to find a circuit which would be just as good as that using a

### PARTS LIST

1 Chassis, 14 x 12 x 3½.
1 Panel, 16 x 12.
2 Shields, 3½ x 6.
1 Tuning dial.
6 Midget condensers (see article).
4 Flexible couplers.
2 High-gain intermediates.
1 Beat oscillator coil.
1 Power transformer, 385-0-385 at 80 mills., 6.3 mills. at 3 amps., 5v. at 2 amps.
1 5000 ohms potentiometer.
1 50,000 ohms potentiometer.
1 .5 meg. potentiometer.
1 Switch.
2 8 mfds. electrolytic condensers.
1 25 mfds. electrolytic condenser.
2 .5 mfd. tubular condensers.
6 .1 mfd. tubular condensers.
1 .0001 mfd. mica condenser.
2 .02 mfds. mica condensers.
1 .01 mica condenser.
1 .001 mica condenser.
1 .00025 mica condenser.
1 50,000 ohms resistor.
1 5000 ohms resistor.
1 25,000 ohms divider.
2 .25 meg. resistors.
1 300 ohms resistor.
1 150 ohms resistor.
5 Octal sockets—2 5-pin, 16-pin, 14-pin.
Valves—6K7, 6K86, 6B8, 6C86, 6F6, 80.
Speaker—1500 ohms field.
9 Coil formers, hardware, etc.




*The circuit of the receiver shows clearly how the headphone jack is connected. The beat oscillator coil has the grid leak and condenser contained inside the can.*

valve for the second detector plus the extra valve for the beat. We believe that this exists in the 6C8G.

In our last call-sign book we used a 6A6, with one section as a leaky-grid detector and the other section as a triode beat-oscillator. We have used the set quite consistently until recently, particularly for 10-metre work. This has given us a chance to observe the operation of the system of a dual-wave performing these two functions, and, again, we are satisfied that one can dispense with the usual separate beat-oscillator valve without dispensing with satisfactory operation.

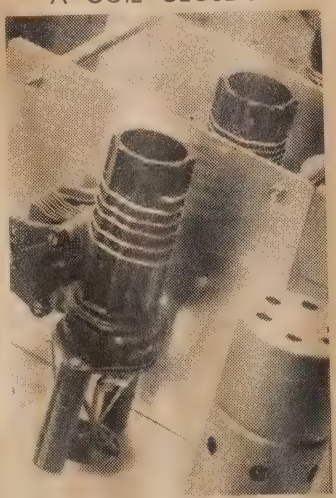
The 6C8G is a valve with two triode sections of medium-mu characteristics, each having a separate cathode. Thus it is in effect two separate valves. Now, as everyone knows, the coupling between the beat-oscillator and detector circuits needs to be very small indeed, if we are to avoid high noise when the oscillator is switched in. The capacity between the two valve sections in the one envelope is quite sufficient for this purpose, and when the beat is turned on one can obtain just as strong an injection as he could desire just by varying the plate voltage on the beat section of the valve. What could be simpler?

## BIA SED DETECTOR

We have used the first section of the valve as a biased detector, which will give ample output to operate headphones, and plenty of "sock" for the high gain pentode in the output stage. The 6A6 made necessary a plate-feedback oscillator coil, which in our case was made from an intermediate transformer with the trimmer removed from the plate winding, the other trimmer being used to tune the grid circuit to line with the rest of the set.

Having a separate cathode, the 6C8G is even better, because we can use a simple beat coil with a tapping to which the second cathode is connected. We had a special coil made up for this service, which included the condenser and grid leak inside the can of the coil itself. Thus only three connections are required, one for the grid, one for the cathode, and the other is the earth connection for the secondary. A couple of inches of wire run from the coil over to the valve, and that is all there is to it. A glance at the wiring diagram shows how simple this is.

## A COIL CLOSE-UP



*This close-up of the oscillator coil shows how the coil sockets are mounted up on distance pieces.*

## PLATE FEED

The plate supply for the oscillator section is fed through a fixed resistance in series with the on-off switch, which cuts the voltage when the oscillator isn't required. This resistance is necessary for stability, otherwise changes in high-tension voltage will affect the stability of the oscillator. If a weak beat is required, use a high resistance—.5 meg, or even 1 meg. If a very strong beat, a smaller resistor of, say, .1 meg, will be enough for anyone. We compromised, and used .25 meg. for the job.

The separate cathode allows us to use the detector section in a biased circuit, as the leaky grid idea, with its condenser and leak in the open, is more sensitive, but prone to introduce hum, and will block easier on strong signals.

## THE CIRCUIT

That's how we eliminated two of the valves which the ordinary man puts into his set. We can now use one of them for an R.F. stage, and the total is re-

duced to six valves in all, doing the same job which the average man attempts with eight.

Let us now run through the circuit. First, we have the R.F. stage. This we have shown with regeneration, and we have done so with mental reservations. We aren't altogether sold on this idea of regeneration. It makes the first circuit tricky—some say cranky—and although it does increase the gain, it also increases the noise when pushed past a certain point.

Just ability to turn up the regeneration and get more noise doesn't mean better signals, although how many think it does? As a matter of fact, we found that by using low-capacity tuning circuits, with a 6U7G type of valve, we were able to get practically the same gain as with the regenerative stage.

Again, it's hard to find a spot where regeneration is smooth and easy, while maintaining at least 70 volts on the screen before going over into oscillation. It's mainly a matter of balancing regeneration against aerial loading. If a tuned aerial is used, regeneration will be damped out very sharply as the resonant spot, and tend to fly off the handle at all others. Still, it can be tamed quite well, and it's worth playing about with until the best results are obtained. And it's no harder in this set than in any other.

The mixer, as we have said, is the 6K8G.

This feeds into a conventional I.F. stage, with variable gain, controlled by a variable resistance in the cathode circuit. There isn't much we can do here, except use good intermediates. We had special high-gain jobs developed for the set, using Trolitul insulation, but any good intermediates will serve.

The second detector is the 6C8G.

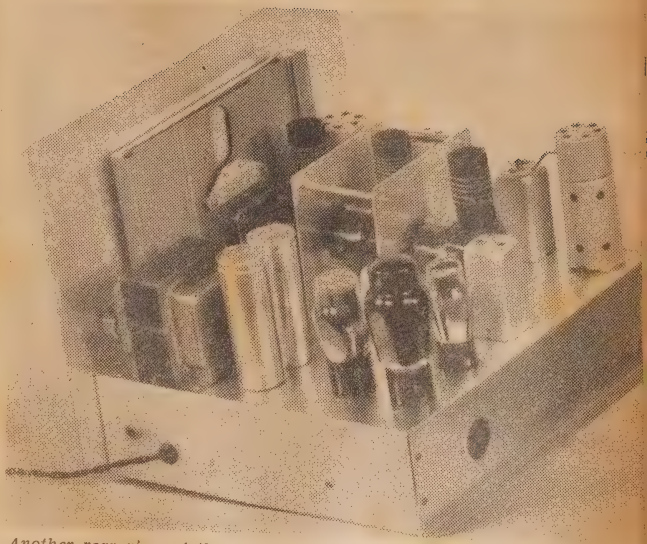
## OUTPUT SECTION

The output valve is the Brimar 6AG6-G. This was used because it is probably the easiest valve to drive for high output. Only a couple of volts drive are required to give about 4 watts output, should this be necessary. It makes up for lack of an audio driver. But then, how many amateurs need to use their sets at more than about 250 milliwatts output? Again, it's the old idea that a big noise means an R8 signal, which a smaller one doesn't. Fortunately, most people are beginning to see its foolishness. Consequently, although this valve is most suited to the position, an ordinary 42 or 6F6 output valve can quite well be used.

The rectifier is an 80, and the power supply conventional.

## THE COILS

Don't lose your hair when you see the large number of turns we have used on the secondaries of the tuning coils. It's the best way we know of to get sharp tuning and gain. At least one amateur who heard this set went home, and practically doubled the turns on his own coils, with most definite improvements in gain and selectivity. There's nothing like the use of small condensers and big coils to make a set perform. That's one reason we get such good gain and clean tuning.

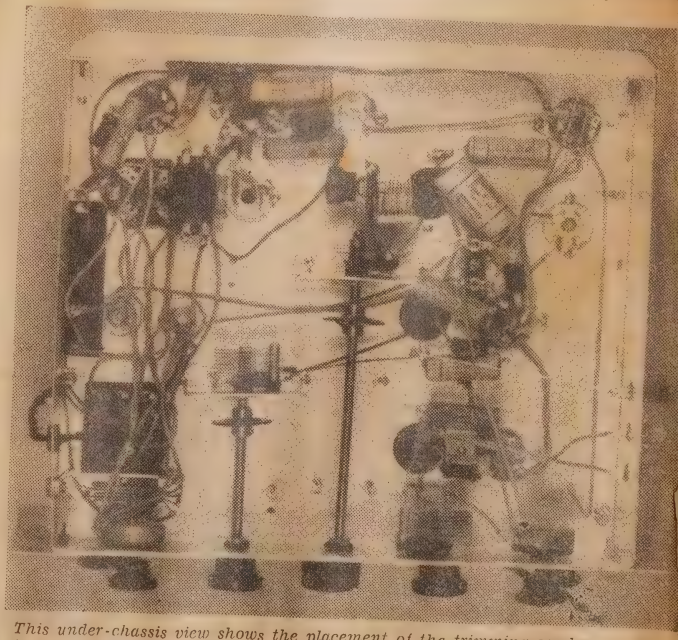


*Another rear view of the set shows the audio end and power supply. Th speaker socket can also be seen. The phone jack is near the outlet for th power cord.*

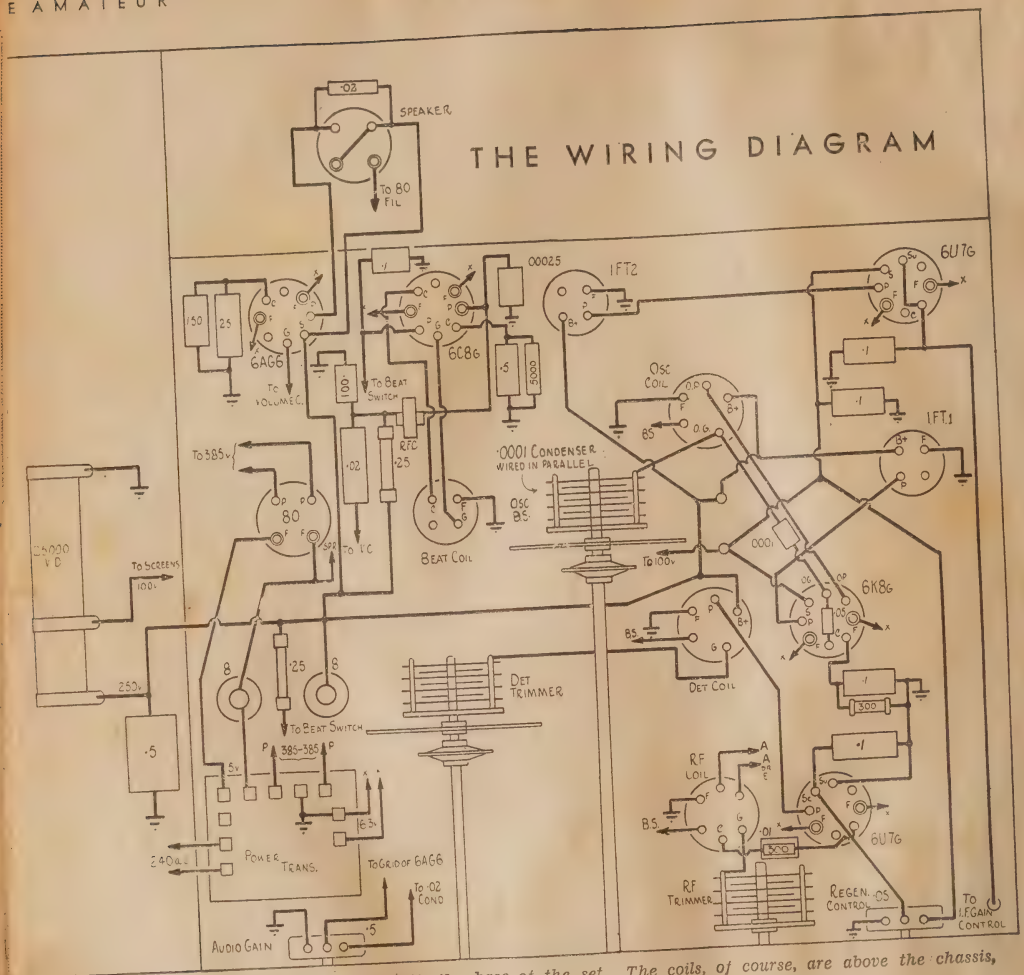
The set as photographed used .0001 midgets for trimming these coils, but only the last little bit of the tuning range was made use of. Since then, these condensers have been reduced to about 15 mfds. to give a vernier effect in the small trimming adjustments that have to be made to the R.F. stage with regeneration, and nothing could easier than the well-controlled they peak up on signals.

## THE OSCILLATOR CIRCUIT

It's a different story in the oscil circuit. Here there are only two th



*This under-chassis view shows the placement of the trimming condensers and the two oscillator band-set condensers. Note the few components which are necessary.*




*This diagram shows all the wiring underneath the base of the set. The coils, of course, are above the chassis, and the leads run through to them.*

worry about—stability, and enough ection voltage for the mixer. High-C ils are no disadvantage here, and are be preferred, mainly in the interests stability, and, secondly, as an aid good circuit tracking over the various ands.

An article covering this point recently ppeared in "Wireless Weekly," so we on't want to cover the ground in etail again.

But the use of a big condenser here—0001 fully meshed—mak s the location f the marker station for band-setting ery critical. It's like tuning the re-eiver without even the aid of a decent ial. So we evolved the scheme of sing a fixed condenser in the circuit to maintain the C of the circuit, and con-necting a smaller one of about 15 mmfds. across it. By adjusting the turns on the oscillator coils so that the band-set station marker falls inside the range of this vernier trimmer, it's the easiest thing in the world to locate the marker after the coils for each band are plugged in. More than this, the tuning has lost its very critical nature, so that it is quite simple to bring the marker to its spot on the dial with the use of an ordinary knob or pointer. This simple idea is not to be appreciated until it is put into practice.

We tried the use of a fixed condenser of .0001 mfds., instead of the large variable type, with perfect success. However, a variable type makes it easier to adjust the coil turns when making the coils, in case you start off with a number that won't allow the marker to hit resonance in the range of the vernier.

Accurate condensers of the fixed type may be obtained from the makers of T.C.C. or Chanex condensers, if you ask for them.

The leads above the chassis include those indicated on the above diagram, running to the bandspread condenser, and the leads from the intermediates to the caps of the respective valves. The I.F. Gain control is also above the chassis, as is the beat switch.

## BANDSPREAD

Every amateur receiver needs a good bandspread system. Again, we wrote an article about this in "Wireless Weekly," to which you can refer if you desire. The long and short of it is that we adopted the method of using standard 100m. mfds. midget condensers tapped part of the way up the secondaries to get the right amount of bandspread. It's a very simple and effective scheme. The coil data for the set will probably allow you to hit the right adjustment

straight away. If not, work on the oscillator section first. If not enough spread is obtained, tap the coil nearer the earth end. If too much, move the tap nearer the top.

Having got the dial spread you want, you may find that the R.F. and detector trimmers need adjustment from one end of the band to the other. If the condensers need increasing capacity as you go lower in frequency, move their bandspread taps nearer the grid ends of the coils, and vice versa. You should be able to strike an adjustment where tracking is practically perfect all over the dial. We used bare wire for the 20-metre coils, and soldered the taps direct to the wire from the outside until the right spot was found. As a rule, it will be the same number of turns for all coils, with the .0001 capacity in the oscillator circuit. Note that the oscillator coils are much smaller than the others. Obviously, this has the same effect as would padding condensers, in effecting the correct lag between oscillator and signal-frequency circuits to maintain the right frequency difference between them.

## COIL DATA

Cathode coil for 40 metres has 8 turns of 20 gauge enamelled wire o 1 inch former spaced to 1 inch.

Plate coil of 6L6G has 10 turns for 20 metres, and 20 turns for metres, wound on 1¼ inch formers, with 20 gauge enamelled wire, spaced 1½ inches.

Final tank has 30 turns of 1-8 inch tubing for 40 metres, 16 turns 3-16th tubing for 20 metres, and 8 turns of 3-16th tubing for 10 metr all centre-tapped.

This coil data should serve as an accurate guide, but is subject slight change to suit conditions. Final tank coils 2 inches in diamete and spaced over 4½ inches.

| | *R.F.* | | | | *Detector.* | | | *Oscillator.* | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Band. | A. | G. | Tap. | B.S. | P. | G. | B.S. | P. | G. | B.S. |
| 20 | 6 | 13 | ½ | 2 | 6 | 13 | 2 | 4 | 6 | 2 |
| 40 | 10 | 23 | 1 | 5 | 10 | 23 | 5 | 5 | 12 | 5 |
| 80 | 15 | 45 | 1 | 12 | 15 | 45 | 12 | 10 | 24 | 12 |

Coils are wound on 1½ inch formers. Use gauge 20 tinned wire for metre grid coils, also oscillator grid coils for 40 and 80 bands. All othe wind with 26-gauge enamelled wire. Primaries are interwound. Aeri coils wound at earthed end of grid coils, and spaced for best regeneratio Oscillator coils for 20 and 40 metres spaced to one inch, all other to inches. This data should prove a good guide, but is subject to sma variation to suit your particular case.

## THE DIAL

The dial is another of those little things the average amateur doesn't seem to worry enough about. Why use a dial marked in 0-100 scale when the stations don't come that way? Surely it is a simple matter to use a standard broadcast dial of good make, paste a thin card or drawing paper scale over the glasses, and calibrate the thing yourself? A bit of work with some compasses will result in the required number of "lanes" being drawn in, one for each band, upon which you can mark in pencil any checking spots you desire, plus any unusual stations you happen to hear, and want a record of their frequency.

With the band-spread arranged to cover the whole dial, we have as much as seven inches to play with on each band. Just imagine how convenient that is when using your set. No more mental arithmetic or tuning charts to work out your frequency. It's there staring you in the face, no matter where in the band a station may be.

Good dials can be obtained for very little more than many popular 0-100 types, and the difference—well, it's again one of those things you must use to appreciate.

Our preference is for the big straight-line type of dial which has maintained its accuracy for nearly three years in the 2JU Ten, but it costs a fair bit, and the semi-circular types are quite satisfactory. And if you get good dials, such as the Efco's we have been using, there won't be any backlash that you could notice. If you like to work out the distance represented by 1 kc. in 400m., but spread out over about seven inches, you'll see that it represents about 1/60th of an inch. You can get readings as close as that if your dial and condensers are lined up properly, and on 20 metres, too.

## TUNING CONDENSERS

The tuning condensers we used are a new type put out by R.C.S. with Trolitul ends, and suitable for ganging. Many people incidentally blame a lot of things for backlash in ganged condensers when they should be blaming their roughly fitting couplers. It is ess to use couplers which really do shafts and don't allow about 5 to spare. How can you keep the line when you tighten up grub s which do their best to put them

The partitions also must be of metal—16 gauge at least. Take ti getting the mounting holes exactly site each other, with a bit of clea to allow for your errors. Spend trouble in seeing that the three ca rotated by hand with an ordinary without binding or weaving, before finally put the dial in place. The will drag 'em round all right, but won't get decent results if the assembly ties itself in knots in the cess. Plenty of others have done job well, and you can do it, too.

Incidentally, there is a front su for the first condenser apart from dial, so that the whole assembly one piece, even without the dial in Take care that the dial is also mou firmly to the chassis. Our dial rests on the front of the chassis, with a c of small feet to keep it there. The no strain on anything when the asse is in action, and there mustn't be, i want to split those kc.'s on the t dial.

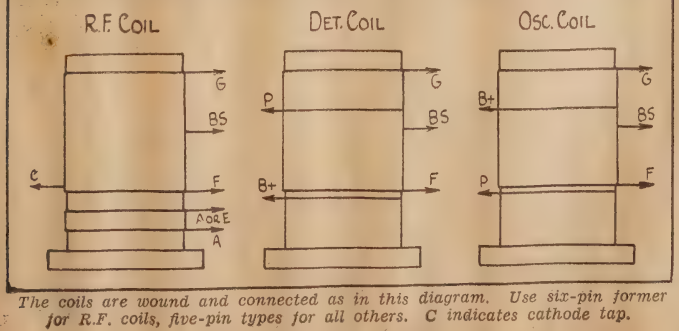
Incidentally, the use of a cut- tuning gang is quite permissible, quick method of avoiding lining tro with three condensers. But this make your leads a bit longer, and merits of the two methods just a balance. But for layout in case, the midgets have it. There several suitable brands on the ma

## LAYOUT

Take note of the extremely neat la of parts. The coil sockets are mou upon spacers so that the connection

(Continued on Page 45)

## COIL CONNECTIONS




*The coils are wound and connected as in this diagram. Use six-pin former for R.F. coils, five-pin types for all others. C indicates cathode tap.*

*low to make an*

# ANTENNA RELAY

By A. J. BARNES

S well we know the range of amateur transmitting components that are purchasable "over the counter" is extremely limited, and ind it necessary in many cases to our own."

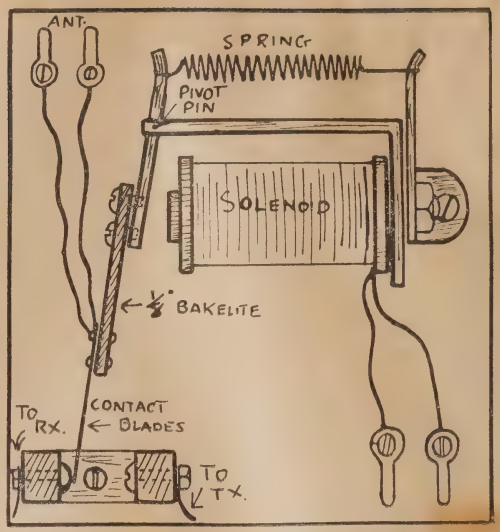
his double pole, double throw nna relay is no exception to the ral rule, and although a fair know- of tools and their handling is re- d for its construction, the trouble is well worthwhile. Snappy ge-overs, push-to-talk and ease of on operation are a few features e possible.

e have not gone into extensive il as far as dimensions are con- ed; only a few measurements are , and the rest is left with the hes, which are in proportion. If an at least convey the idea, a little monsense on the constructor's part ld see the job through.

## HOW IT WORKS

bakelite paddle carrying two spring s extended contacts oscillates be- n two pairs of stationary contact s bolted through the legs of a aped piece of bakelite or other in- ting medium. At the upper end of bakelite is fitted a steel armature e, and an extension on this plate nked to a spring. This armature e is pivoted to a bracket carrying lenoid.

he spring holds the paddle contacts nst two stationary contacts in the or "receive" position, whilst in the "on" or "transmit" position current drawn from the transmitter passes through the solenoid and pulls the paddle across to the opposite pair of contacts. The antenna leads are soldered to the moving contacts.




*A plan diagram showing the completely assembled unit.*

## MATERIAL REQUIRED

1 piece bright mild steel, 1 inch x ⅜-inch.
1 piece ⅜-inch round mild steel.
1 piece bakelite or formica, 1½-inch x 1-inch x ⅜-inch.
1 tension spring.
Sundry screws, nuts and lugs, etc.
Scrap ⅛-inch sheet bakelite.

## THE CONTACT PADDLE

This consists of a piece of ⅛-inch bakelite with a gap cut in one end. On the legs so formed two spring brass strips are rivetted by brass escutcheon pins. Two ⅛-inch screws hold this assembly to the armature, which is cut from a piece of steel. A 1/16-inch hole is drilled through the armature to carry a pivot pin, and two threaded holes carry the screws for securing the bakelite. The upper end of the armature is very narrow, and hooks into the spring.

## THE MOUNTING BRACKET

The other end of the spring is looped over an extension lug formed in the mounting bracket. This bracket carries the solenoid, pivot bracket and paddle assembly.

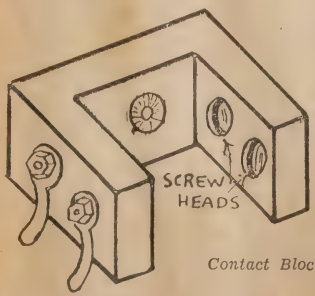
## THE SOLENOID

This is made up from a piece of ⅜-inch steel rod and two washers. One end of the rod is reduced to ¼-inch diameter and threaded to take a nut; the other end is spread slightly with a few hammer blows. Now we slide over the rod a washer, then a piece of metal tubing, and then the remaining washer, and thus form a bobbin on which we wind first a layer of paper, and then four or five hundred turns of fine wire. The relay in use at the writer's station is connected in series with high tension negative of the power supply for the exciter (47 and 6L6). The wire used was robbed from an old intermediate tranny.

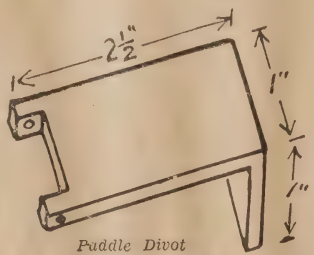
## THE SPRING

This is a tension spring (closed coils), and is just strong enough to maintain a good contact in the "receive" position. Thus the solenoid has only to exert a light pull. However, in our own case, it is almost impossible to pull the armature away when in the "transmit" position, thus a good contact is assured. A little experimenting with spring tension and or solenoid winding may be found necessary.

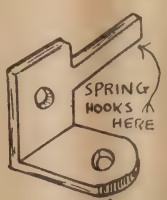
**(Continued on Page 43)**




*Contact Block*




*Paddle Divot*




*Main Bracket*

# Your first TRANSMITTER

## 50 watts on 3 bands

Simplicity of construction and adjustment are the main features of this fine little transmitter. Its efficiency is particularly high, and full ratings are available for the 809 on any of the three bands. May be modulated for phone.

*The transmitter from the front. Wooden chassis ends make "rack" construction particularly easy.*

THE amateur transmitter, when faced with the problem of going on the air, must consider, first of all, how he is going to get his allowable 50 watts of input, assuming he desires to use it all. He can go about it by building a transmitter with many stages, which, when finished, will give him 50 watts on three or four bands, look imposing, and cost a fair amount of money. No one would quarrel with the man whose ideas ran on those lines ——in fact, he will probably end up with a very fine transmitter and learn a good deal in the process. No doubt he will also have to know a good bit about the game to make a real success of the job, apart from anything else.

But there is another way of attacking the problem, which is essentially applicable to the new amateur. When building a first transmitter, which generally means an entirely new set of parts from the ground up, cost must play a big part. In fact, our advice to anyone using transmitting for a hobby is: Go easy on the pocket. Don't rush in and buy a lot of gear all at once!

Therefore, the solution which will provide the biggest appeal is the one which gives the most for the least money. A simple transmitter, which works well covers three bands from one crystal, and gives efficiency on all of them—this is the ideal equipment with which to start out.

It is exactly for this purpose that we have built and described the transmitter illustrated on these pages. Although meant primarily for the beginner, there is no reason at all why such a transmitter should not give excellent service to any amateur who looks for results at low cost.

### PERFORMANCE

Although only two valves are used in the circuit, this transmitter is capable of giving with high efficiency that 50 watts on three bands of which we were speaking. For instance, with a 40-metre crystal, 40, 20, and 10 metres may be covered merely by changing coils and retuning two controls. With an 80-metre crystal, 80, 40, and 20 metres can be covered. As a rule three bands is all any amateur will cover at a time, and, in any case, he would scarcely expect his transmitter to include them all unless he is a quick-change expert. Our experience is that the average man rarely uses even three bands regularly over a period. If he covers 80, he will generally run to 40, but rarely 20 or 10. If he is a 20-metre crank, he rarely goes up to 40, but often to 10. In other words, three bands will cover the needs of practically everybody. If two crystals are available, one for 80 and one for 40, four bands can, of course, be covered.

Remember, this is with only two valves.

★ THREE BANDS — ONE CRYSTAL
★ FIFTY WATTS ON EACH BAND
★ TWO TUNING CONTROLS
★ ONLY TWO VALVES USED

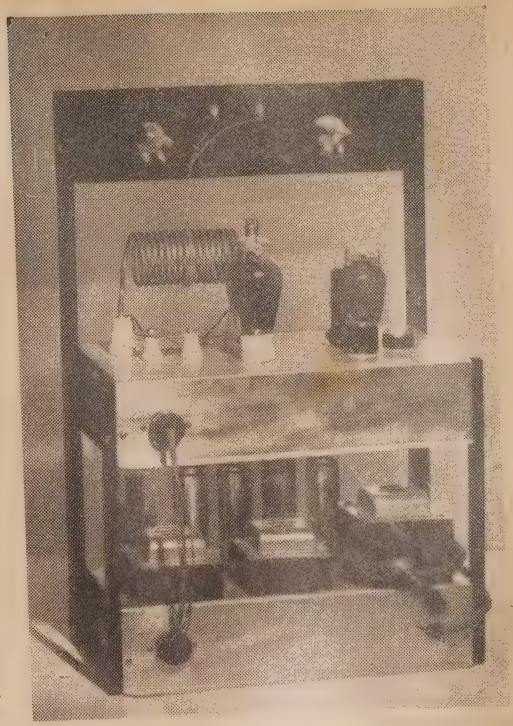
### THE OSCILLATOR

The first is a 6L6G type. It is used as a crystal oscillator and doubler. The final amplifier is an 809 type, also used as an amplifier or a doubler.

An oscillator circuit is used for the 6L6G, which is a variant of the Tri-tet circuit, and needs only one tuning control—that in the plate circuit. The cathode tuning is fixed and need not be touched unless a crystal for another band is desired. For instance, if only 40-metre crystals are used, the coil will suit any of them. If an 80-metre crystal is used, it will be wound for 80 metres, and will suit any such crystal. If a change is desired between 40 and 80 metre crystals, this coil should be made a plug-in type and mounted on the chassis in the normal manner. In our case we have used a coil soldered straight into position under the chassis, where it is out of the way.

This circuit we have found highly efficient—provided the right cathode coil is used the crystal current is not high and the output on the harmonic is practically as high as that on the fundamental.

It can also be used as a straight crystal oscillator without any feedback, as will generally take place with a straight Tri-tet. Useful output can be obtained on 10 metres from a 40-metre crystal, but we find it a much better scheme to double in the next stage, par-



*This rear view of the transmitter gives further constructional details. Note the power cable joining the two chassis. A tuned aerial coupler may be used if required.*

cularly as the 809 is such an excellent oubler.

## NO REGENERATION?

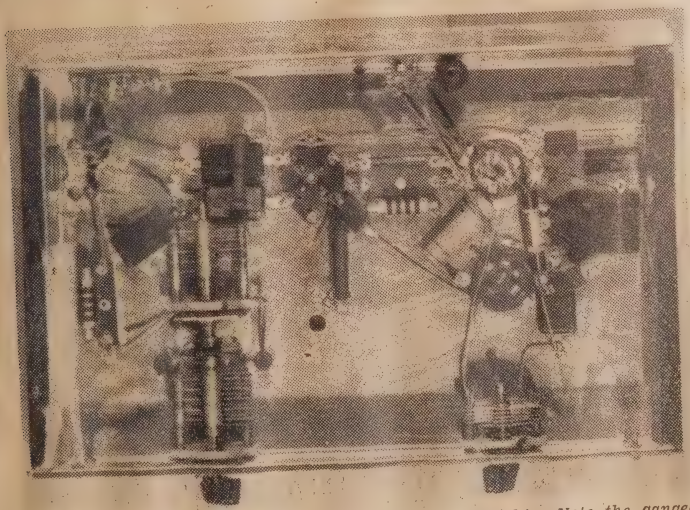
Before adopting this oscillator circuit, ve spent a good many hours playing vith regenerative circuits in order to find out their advantages and disadvantages. Our final conclusions are that such circuits are quite all right—particularly the circuit which uses a common condenser to ground the crystal and the plate tank coil. But they do take very careful handling, and particularly the beginner is likely to tie himself into some terrible knots trying to make them talk sense.

We found it impossible to strike a value of feed-back condenser which would allow good harmonic output without giving too much coupling when used on the fundamental. By making the coupling condenser variable, our troubles were almost eliminated in this regard, but an extra control was added with still the possibility of getting things out of control. And we found that crystal current can rise high enough under certain circumstances to considerably heat our Bliley crystals. Lower quality crystals would certainly be in danger of fracturing under such conditions.

Whereas in the circuit we have used, at no time is the crystal subject to abnormal current outside the capabilities of a good "rock" and there is no need for the extra control when using the fixed cathode coil. We feel sure that the uses of regenerative circuits, except in experienced hands, can only bring unnecessary headaches. Particularly as in this circuit used here no trouble was experienced in driving the 809 efficiently at any frequency.

The ordinary circuit using a single-section tank condenser in the 6L6G plate circuit has its rotor plates at high potential. This means the possibility of getting a "bite" from the shaft or indicator grub-screw, and the necessity of insulation from the chassis. To avoid this, we have included in the low potential end of the coil a fixed mica condenser of .01 mfds. By doing this we can mount the condenser direct to the metal panel and as a result construction is simplified. A good mica condenser of this capacity should have no trouble in handling the R.F. current flowing in the tank circuit. Circuit efficiency is exactly the same with this connection, as it is with the normal method.

Apart from these points, the oscillator hook-up is straight going, and there is nothing more to worry about here.



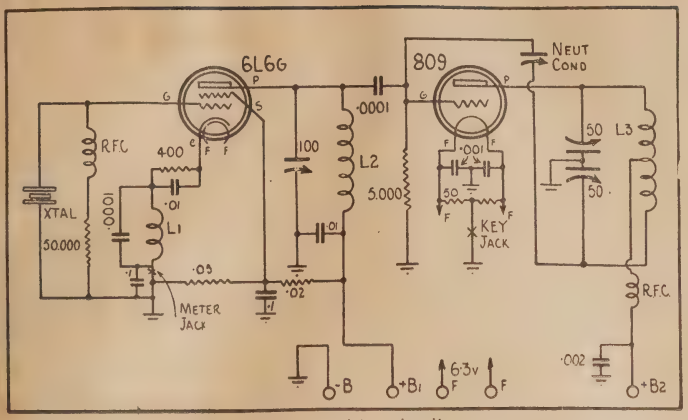
*Under the chassis. The fixed cathode coil is at the right. Note the ganged condensers used for tuning the final tank circuit.*

## THE 809 FINAL STAGE

A conventional circuit is used for the final stage. This uses a Radiotron 809, which, in many ways, is the ideal amateur transmitting valve. It will take an input of 50 watts and more with the greatest of ease—in fact, experimenting, we have employed more than 100 watts input with no color on the plate. It is very robust, and has a high efficiency on all frequencies. Lastly, it is not hard to drive. Its 6.3 volt filament allows us to use a single filament winding for both valves in the transmitter.

The coupling to the 6L6G is by a fixed condenser of .0001 mfds. The bias for the 809 is obtained from a grid resistor from the grid of the valve to earth. Sometimes an R.F. choke is used in series with the grid leak, but we didn't find that it made any difference, so we did not include it.

The standard value for this resistor




*The transmitter circuit.*

## PARTS REQUIRED FOR TRANSMITTER

Chassis, 15 x 9 x 3½.
2 50 mmfds. double-spaced midget condensers (Raymart).
1 100 mmfds. midget condenser.
1 50,000 ohms 1 watt resistor.
1 50,000 ohms 3 watt resistor.
1 20,000 ohms 10 watt resistor.
1 5000 ohms resistor, 50 mills.
1 400 ohms resistor, 100 mills.
1 50 ohms C.T. filament resistor.
2 .1 mfd. 400 volt tubular condensers.
2 .01 mfd. mica condensers.
2 .001 mfd. mica condensers.
1 .002 mfd. mica condenser.
1 .0001 mfd. mica condenser.
2 R.F. chokes.
2 Jack type stand-off insulators.
2 Small stand-off insulators.
Sockets—1 octal, 1 4-pin, 2 5-pin.
Coil formers, copper tubing, indicating knobs, etc.
2 Jacks.

is 5000 ohms, at which value it gives the right grid bias when approximately 30 mills are flowing in the grid circuit. This value may be increased to 7500 ohms or even 10,000 ohms if the 809 is used consistently as a doubler. However, we have used 5000 ohms in this case, as the transmitter so far has been used mainly on 20 metres.

### THE SPLIT-STATOR

A split-stator tuning condenser is used in the final tank circuit. As with the tuning condenser for the 6L6G plate, we have mounted it underneath the chassis. This is very convenient, and allows the control to be brought out on the front panel. One of the advantages of the split-stator method is that it leaves the rotor of the condenser at earth potential, and the two Raymart 50 m.m.fds. condensers we used can be mounted direct to the chassis. A stout bracket of 16 guage aluminium supports the second condenser, which is connected to the first through a flexible coupling.

The leads from the fixed plates of the condensers run through holes in the chassis up to the ends of the plate or tank coil, which is plugged into stand-off insulators. Use good, solid rubber grommets for these holes, make the connections with stiff wire, about 14 gauge if possible, and space them so that they are not in contact with the rubber. This isn't essential, but it guards against any possibility of leakage.

### THE POWER SUPPLY

The power unit is divided into three sections. The first is the filament transformer, which supplies 6.3 volts for the transmitter filaments, and 5 volts for the rectifier. There is no reason why a couple more windings should not be placed in this transformer, as there is plenty of room for them, and it will enable you to play round with other valves from time to time should you desire to experiment.

The second unit is the filter choke to carry 175 mills.

The third unit is the high tension transformer. This has an output of 600 volts per side at 175 mills. This rating is required because the final stage may run anything up to 100 mills, and the oscillator will take approximately 60 mills. There are no filaments on this transformer. It is essential to be able to switch it off without affecting any filaments, and in any case the practice of placing filament windings on the power transformer isn't a good one when voltages as high as 600 are concerned.

## PARTS REQUIRED FOR POWER UNIT

Chassis, 15 x 9 x 3½.
Power transformer, 600-0-600 at 175 m.a.
Filament transformer, 5v. 3a., 6.3v. at 35a.
Filter choke, 30 H. at 175 m.a.
4 600-volt peak 8 mfds. electrolytic condensers.
3 Switches.
1 3500 ohm resistor, 80 mills.
3 Switches.
Sockets—1 4 pin, 1 5 pin.

### FILTER CONDENSERS

The filter condensers are 2 mfds. electrolytics of the Solar 600 peak volt type, two being connected in series for each side of the choke. We have omitted the usual resistors across the condensers which are really preferable when they are used this way, because the voltage across each is only about 300, and these resistors are essential only when the working voltage approximates the maximum allowable for the condensers. However, .25 meg. resistors may be connected across each condenser if desired.

The rectifier is an ordinary 5Z3. Three switches are used for the transmitter. One is a master switch, which energises the filament transformer for a start. The second switches in the high-tension, and this latter cannot be turned on before the master switch is in action, so you can't turn on high tension without knowing it. A third switch is used to break the high tension to the final, used really only for testing, and not normally operated when the transmitter is in action. Good switches are quite essential here.

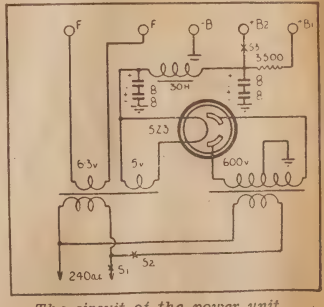
A five-way cable connects the power supply to the transmitter. We have made it to plug into both chassis for convenience. If only one plug is used keep the socket on the power unit, so that you can't possibly have live prongs lying round if the power supply should be turned on while not connected to the transmitter.

### NEUTRALISING CONDENSER

We made our own neutralising condenser in a very simple fashion, by cutting two plates from aluminium sheet and mounting them on two stand-off insulators. Washers are used to maintain spacing between the plates, which can be operated by swivelling the top one with a stick of wood. Such a condenser is very easy and cheap to make although a manufactured type can, of course, be used with equal efficiency. Our close-up photograph shows the construction of this little condenser. The plates may be about 1½ inches by 1 inch in size, and spaced about 1-16th of an inch.

### CONSTRUCTIONAL

Several points in the construction of the transmitter are worthy of mention




*The circuit of the power unit.*

The chassis were cut from aluminium, bent to size, and fitted with wooden ends about ½ inch thick. Apart from the convenience of being able to "rock-mount" such chassis on wooden uprights, the wooden ends tend to stiffen the metal. Any number of such chassis may be mounted one above the other, by running through the upright's ordinary wood screws, which penetrate the wooden ends. In our case we used about 2 x ½ inch wood for the front uprights, and ½ inch square for those at the back.

The jacks are mounted on bakelite squares screwed to the insides of the wooden ends. One-inch holes through the sidepieces are cut for these with an ordinary wood bit. The meter for checking plate currents may be plugged into these jacks without cluttering up the front panel. Incidently a 0-150 mill. meter may be mounted on the front panel of the transmitter if desired, and it will serve equally well for each stage.

The jack in the centre-tap of the 809 filament may be used to read its plate and grid current, or by breaking the high tension lead with the switch, it will indicate the grid current alone. This jack is also used for the key, as the American practice of keying crystal oscillators, while it has much to recommend it, demands the use of very good crystals.

The bakelite panel we used for the front of the transmitter chassis was placed there for appearance—it is quite permissible to use the plain metal, as the condensers are in contact with it anyhow.

The coils for the oscillator plate circuit are wound on ordinary formers. It is not easy to get formers which will stand 50 watts input for the final stage, so we have used plug-in coils made of copper tubing. The coil shown is made of 3-16 copper, but ¼in. tubing is in some ways more suitable, and should be used for the 40-meter coil. The 80-meter coil may be wound with lighter gauge wire, on a former, to which a couple of plugs are attached.

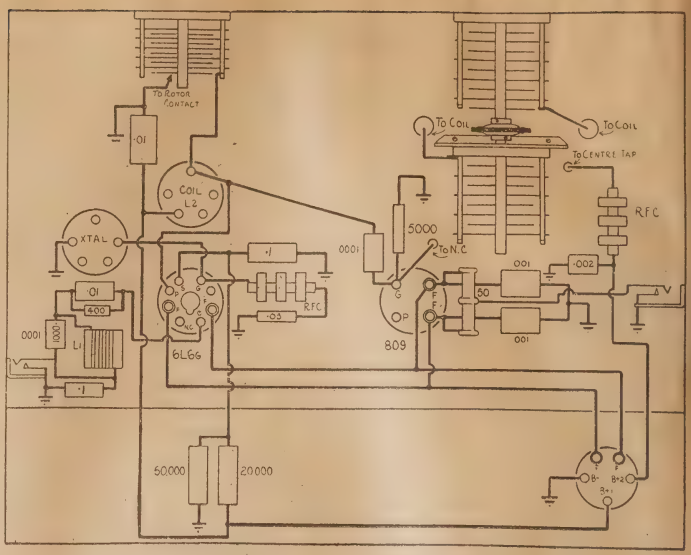
The coils themselves plug into a pair of Birnbach stand-off insulators. Another advantage of using the tubing is that the coils are self-supporting, and are very hard to damage. They are all centre-tapped for neutralising, and if these taps are made accurately, the same neutralising setting should suit for all bands.

Most of our testing has been done with a 20 metre matched impedance feed aerial, but the aerial tuner panel carries a couple of condensers if tuned feeders are used. Any of the standard aerials may be employed, according to taste. We suggest link-coupling the final stage to the aerial tuner. Ordinary hook-up wire will be sufficient for the link, although rather heavier gauge rubber-covered cable would probably be a little better.

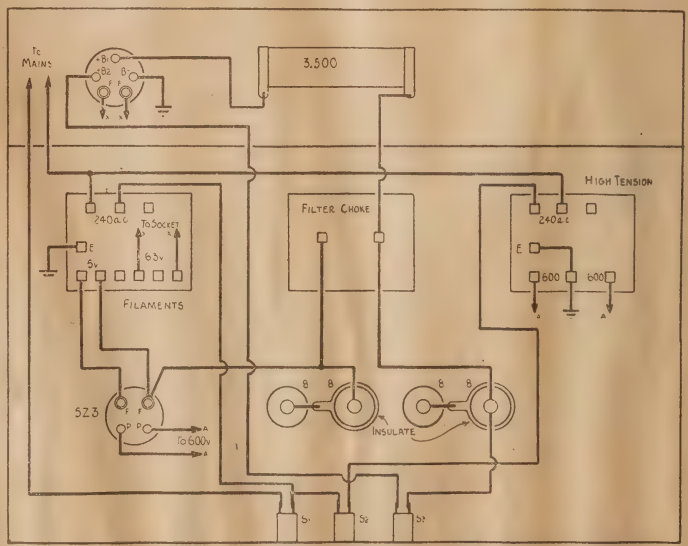
## OPERATION

It is quite easy to get the transmitter in operation. Having made sure that all the components are correctly wired, and that the hook-up is correct, turn the filaments on. Allowing a few seconds for the 6L6G to warm up, switch on the power. Have on hand the usual test loop, consisting of a single turn of wire and a pea-lamp. Bring this close to the top of the oscillator plate coil and it should light brilliantly when the plate condenser is tuned to resonance, which will probably be about half to quarter way out of mesh. Tune for maximum brilliance.

Now for neutralising. Set the neutralising condenser plates about the same amount as those in the photograph, and tune the 809 plate coil through resonance. The lamp indicating output from the 6L6 will probably dip as you run through this resonance point. The idea is to adjust the movable plate of the neutralising condenser until you can tune through this point with no change in this lamp's brilliance. The position of the plate will be reasonably critical, so take care over it. Push it a little at a time with a piece of wood, until the dip begins to get less and less pronounced. Probably you will need to readjust the 6L6G plate condenser from time to time to keep the stage in tune. When finally you get a setting which will allow you to tune through resonance without any




*The wiring diagram of the transmitter.*




*The wiring diagram of the power unit. S1 is the master switch, S2 controls the high tension, and S3 can be used to break the voltage to the final stage.*

change in the lamp's brilliance, the stage is neutralised.

A further check is to plug the meter into the final circuit jack, with the plate voltage turned off (as it has been all the time, of course) and tune the plate tank condenser for maximum reading. This will be the grid current, and should be about 30 mills or so. As you tune the plate tank condenser through resonance, there should be no change in the grid current.

Having made sure of the neutralising, see the tank condenser at the spot approximately the same as the spot where the dip originally occurred, so that it will be somewhere near resonance, and turn on the final high tension. Tune the tank condenser quickly until the meter reads the least possible current. On 20 and 40, this will be about 40 mills or so, remembering that this meter reads grid and plate current combined. If the tank condenser should be tuned out of resonance, the meter should kick well over towards the 150 mill mark, and the plate will run red-hot. Naturally, one doesn't do this as a regular thing!

The unloaded plate current of the final, allowing for a couple of mills grid current less when the high tension is on, should be between 10 and 15 mills in resonance, on 40 and 20 metres, while on 10 metres, it will be somewhat higher —about 25 mills. In all cases the stage may be loaded up to 100 mills with safety when the aerial is connected. Don't forget that the meter in the filament circuit will be reading about 30 mills of grid current as well as the plate current, so that the total reading will be about 130 mills maximum. At this reading, no color whatever should show in the 809 plate.

The neutralising and tuning procedure is the same no matter what the band used may be. Naturally, neutralising will only be possible when the valve is acting as an amplifier.

## COIL DATA

The coils for the 6L6G oscillator are wound as follows: The 40-metre cathode coil has 20 turns of guage 20 enamelled wire wound on a 1-inch former, spaced over 1 inch. The 40-metre coil for the plate circuit has 20 turns of the same wire on a 1¼-inch former spaced over 1½ inches. The 20-metre coil has 10 turns on a 1¼-inch former spaced over 1½ inches.

The 40-metre plate coil for the 809 is made of ⅛-inch copper tube, and has 30 turns, 2 inches in diameter. For 20 metres, use 16 turns of 3-16th tubing the same diameter, and for 10 metres, 8 turns of the same tubing. These coils are all centre-tapped, and spaced over a length of 4½ inches. Plugs are fitted to the end so that they fit in the stand-off insulators. All these dimensions should provide quite an accurate guide, but are subject to slight alteration to suit particular cases.

*Showing construction of the neutralising condenser. This tank coil of 3-16in. copper tube, is used on 20 metres. One-eighth tubing will probably be more suitable for 40 metres.*

# AN ANTENNA RELAY

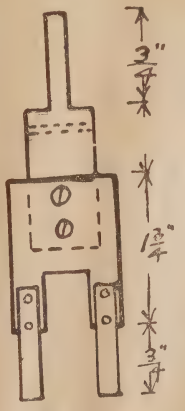
(Continued from Page 36)

## THE CONTACT BLOCK

This is V-shaped, and is cut from bakelite or formica ⅛-inch thick. Cup head brass screws form the contact studs, the nuts holding solder lugs on the outside. The gap in this block is ⅛-inch wide, i.e., the paddle blades move through a distance of ¼-inch or so. A countersunk screw holds the contact block to the base block, which in our case is a piece of red sheet fibre ¼-inch thick and 4 inches square.

The final stage of the writer's transmitter is link coupled to the zepp feeder tuning coil and condenser. This link is broken, and the relay inserted, thus giving tuned antenna input to the receiver via link coupling.

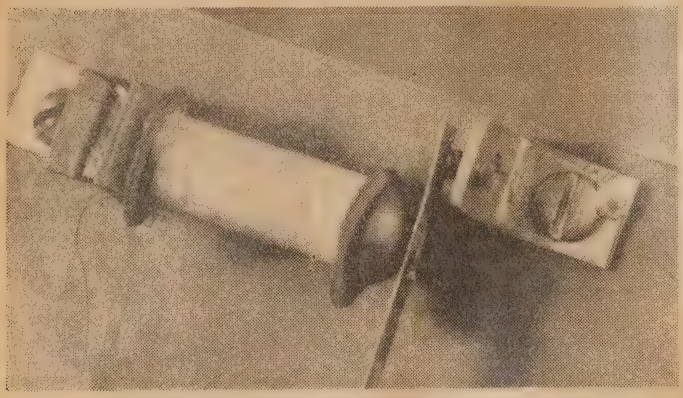
All tube filaments are heated by separate transformers; a telephone type multiple switch supplies 240 volts to the plate transformers when in the "down" position. On moving the switch to the "up" position, the 240 is cut from the plate transformers, and "B plus" is connected to the receiver. The neutral or centre position of the switch cuts both circuits. Thus the whole send-receive arrangement is controlled by a touch of the finger.




*The Paddle*

# HIGH-FREQUENCY BUZZER

## FOR CODE PRACTICE

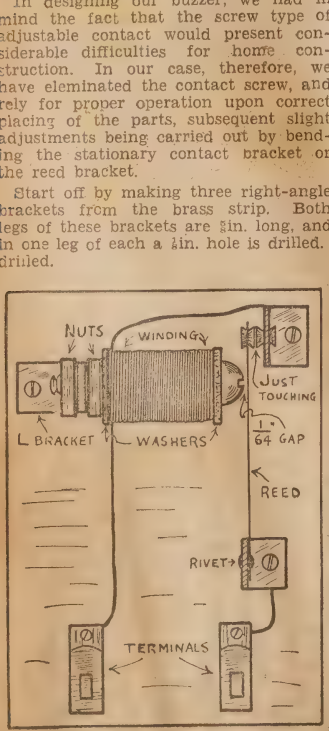


*A close-up of the bobbin, armature, and contacts.*

THIS little high-note buzzer should be just the thing for you chaps who are learning the code. Although requiring an absolute minimum of material and constructional work, the results are all that could be desired.

In designing our buzzer, we had in mind the fact that the screw type of adjustable contact would present considerable difficulties for home construction. In our case, therefore, we have eleminated the contact screw, and rely for proper operation upon correct placing of the parts, subsequent slight adjustments being carried out by bending the stationary contact bracket or the reed bracket.

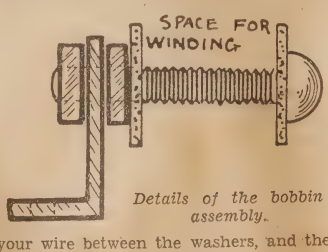
Start off by making three right-angle brackets from the brass strip. Both legs of these brackets are ¾in. long, and in one leg of each a ⅛in. hole is drilled. drilled.




*A plan view of the buzzer complete.*

### THE COIL BOBBIN

Take one bracket and drill a 3/16in. hole in the other leg. Now over the bolt slide the two cardboard washers, then screw on a nut, and then slide on the bracket, which is locked firmly on the end of the bolt by the second nut. Wind




*Details of the bobbin assembly.*

your wire between the washers, and the coil bobbin is completed.

### THE CONTACTS

Remove the porcelain centre from the spark plug and break it open, thus leaving the centre electrode as material for the two contact points. To fit these, we drill holes the same diameter as the electrode material, and into these holes we insert a piece ⅛in. long, then spread slightly on each side with a few hammer taps on a firm metal support. One such contact fits in a brass bracket, the other into the vibrator reed.

### MATERIAL REQUIRED

**1 piece ⅛in. bakelite, 3in. by 3in.**
**1 piece 18g. brass, ¾in. by 3in.**
**1 3/16in. iron bolt, 1in. long.**
**2 nuts to fit bolt.**
**1 piece of thin clock spring.**
**3 ⅛in. bolts and nuts.**
**10ft. 32g. or nearest D.C.C. wire.**
**2 terminals.**
**2 cardboard washers, ⅛in. diameter.**
**1 old automobile spark plug.**

### THE REED

The reed (or armature) is cut from a very thin piece of clock spring 1½in. long and 3/16in. wide, and before drilling this strip each end is "blued" with the heat from a match. One end is drilled to take a piece of contact material, the other end is drilled to take a small rivet (made from a small nail or escutcheon pin), or you can fit a small bolt and nut. The remaining brass bracket is now drilled and fitted to the reed.

All that remains to be done now is to carefully bolt the components in place on the piece of bakelite, keeping our sketch before you, and then connect up.

Our buzzer will work off as little as 1½ volts (1 cell), provided you carefully watch the following points:—

(1) Use thin material for the reed.

(2) Do not have more than 1/64in. between the head of the bolt and the side of the reed.

(3) Contact points should touch lightly.

(4) Scrape all connecting wires before soldering to or clamping under the components.

### USING THE BUZZER

Having made your buzzer, the next thing is to use it. The advantage of the high-pitched note is that it approximates the sound of a clean C.W. signal, such as you would hear over the air. Many chaps find it hard to readjust themselves to the crystall controlled notes of transmitters as heard in the "cans" or speaker after having practised for so long with a rough-note buzzer.

Naturally, the buzzer won't give as clean a note as will the transmitter, but it's a very close approximation to it.

When practising your sending, don't be in too much of a hurry. If you go ahead, and "tear it out" as soon as you are able to do so, you are sure to develop bad habits, which probably will stay with you the rest of your "ham" life. Sending code is no good if it can't be read. Therefore, pay particular attention to spacing and clean formation of the Morse code characters.

"Your "fist" will eventually become your signature over the air. If you get a good one before you start, you are well on the way towards bringing credit to yourself and to amateurs as a whole.

There are far too many poor senders on the air at the present time—even including well-known amateurs, who should know better. Avoid such things as excessive "roll," just because it sounds smart. Listen-in to some of the commercial stations sending press. These boys have to send clean "fists," or else. . . . You will be able to read them at twice the speed of a poor operator, just because they worry about formation, and not just speed.

# USING A FILE

ONE would not look for trouble when using a file. However, there are several "tricks of the trade" used in turning out a neatly filed job. Usually when the surplus material has been filed away, the remaining surface is finely scored by the passage of the file teeth. This rough surface can be smoothed off by "drawfiling." The final smooth-up can be done by folding a strip of emery cloth lengthwise along your file and rubbing in the usual manner. When filing a flat surface, keep the file level, and avoid "low" edges and a "high" centre.

Filing a curved surface often causes the newcomer bother, the resulting "curve" really being a series of flats. The secret in filing a curved surface is to use two simultaneous movements. The first is the usual to and fro, and the other is an up and down "scrooping" effect; thus the file teeth do not travel in a straight line, but tend to "wrap" round the job.

Unfortunately, as with many of our measuring systems, each nation has seen fit to adopt its own particular type of screw thread. The result is, of course, a perfect maze of varying types and pitches. To mention a few of the more common standards, there are: Whitworth, S.A.E., B.S.F., Metric, B.A., etc.

Of course, some threads are coarse in "pitch" (distance from thread to thread), while others are finer. The coarse thread takes a good hold in soft material, and is mechanically stronger than the fine thread, which, however, is harder to shake loose, and is used extensively in automobile work. For our work, however, it will simplify matters to adhere to the Whitworth standard. Here are a few sizes:—

Bolt diameter, ¼in. Threads per inch, 20.

Bolt diameter, 3-16in. Threads per inch, 24.

Bolt diameter, 5-32in. Threads per inch, 32.

Bolt diameter, 1-8in. Threads per inch, 40.

Of course, the hole must be drilled smaller than your bolt diameter, say, 7-64in. for an 1-8in. bolt, up to 13-64in. for a ¼in. bolt. You can see by this that the thread becomes deeper as the bolt diameter increases.

First a "taper" tap is run through the hole to start your thread, then a "plug" tap cleans the remaining metal out.

Yes, Mr. Engineer, I am "skipping" the "intermediate" tap! When screwing in a tap, take one full turn forward and half a turn backwards, this prevents the cuttings from jamming up (a little "blow" now and then helps, too!) When tapping steel, use a fine oil as a lubricant; brass and castiron are best done dry. Threading a rod is done in much the same way. A preliminary cut is taken with the die opened up; further cuts are then taken with the die gradually closed, until the thread is the proper fit. Before threading a rod, however, it is a good idea to bevel the end, and thus provide an easy start for your die.

# 2JU Special 6

(Continued from Page 35)

the coils are only about ½-inch long. The leads to the 6U7G and 6K8G are also quite short. Those to the trimming condensers for the detector and oscillator condensers are longer. In the case of the oscillator, it doesn't matter, and in the case of the detector, as long as the lead is clear of other wiring, it doesn't matter either. The main objection to long leads is only an objection where coupling is possible, but you must have something to couple to before worrying.

This is true of shielding coils. It is bad to put cans over coils and thus reduce their Q most considerably. The shielding shown in our set is perfectly efficient, and any coupling which can exist isn't worth worrying about. The R.F. stage is regenerative anyhow, so why worry? That's another point that could do with a good sound talking about—the misuse of shielding.

The insulation of coil formers, sockets and the like is, of course, to be made as good as possible. However, as most fellows will use the standard gear, we have used it, in preference to Isolantite formers, etc., which are hard to get and expensive. These will help, but they aren't so important that you won't get worthwhile results if you don't use them.

## ODDS AND ENDS

That's about all there is to be said about the set. There is no adjustment for varying the beat frequency, although a small variable condenser wired from grid to ground would do the trick. But it's one more control, and we don't find the need to use it much.

Keep the leads to the oscillator grid circuit firm, and make them with stiff wire. Any change here will spoil your stability. Also when earthing components associated with any one stage, make these connections if possible to the same solder lug. Anyhow, connect them all up with heavy wire, and fix the whole network with a lead to the earth terminal. This applies to the connections for tuning condenser rotors—don't leave the earth returns to the mercy of several inches of chassis. In most cases it will be all right, but it's so easy to put in that extra lead.

In the diagram, of course, we have shown some components in odd places for clarity. They don't have to be that way, but you can't draw them in if they cross over each other, and make the diagram clear. Most people realise this, but some may not.

## OPERATING

We have covered practically all the points which need watching in construction, so we won't go all over them again. Anyone who has built a simple set should be able to get this one going, because one can't have a much simpler circuit. We've done all we can to make it as easy as falling off a log.

Write to us and let us know if you have any trouble or suggestions. Your letters will help us all.

# OUR POLICY

## *Everything on short waves*

**No Radio Magazine would be complete without a comprehensive Short Wave Section. Our aim is to make these pages the most informative of their kind in Australia. You can help by sending us your reports and comments, which may be of inestimable value to others.**

OUR object each month in these pages will be to give our readers the latest news concerning the world's short-wave commercial broadcast stations, notes on stations being heard in this country, and other items of interest to all short-wave listeners.

Something of interest will be found by the readers who confine their listening to the stronger stations, and perhaps to a greater extent to the ardent DX enthusiast who derives his enjoyment in tuning in the elusive stations not heard so easily.

To the latter listeners we shall give hints and tips to enable them to identify the more difficult stations, and thus obtain verification of their reception.

All stations will be referred to by their frequency in kilocycles rather than by wave-length. To some this may appear difficult at first, but eventually you will find it the only really accurate way of determining a station's position on the dials. To convert frequency in kilocycles to wave-length in metres, divide the frequency into 300,000, while to obtain frequency, divide 300,000 by wave-length in metres.

To help listeners not used to thinking in kilocycles we shall give both frequency and wave-length of all stations mentioned for the first few months.

All times mentioned will be Eastern Australian Standard Time, which is ten hours ahead of G.M.T.

### We Want Your Reports

An invitation is extended to all readers to send in reports on stations heard during the month, and thus let everyone have the benefit of any news which they may have. Let us know what verifications you receive, and also send in any of your best cards, which will be reproduced in these columns as occasion permits.

Give suggestions as to what you would like included in these pages and we shall endeavor to meet your wishes. All correspondence in connection with this section of the magazine should be addressed to Radio Hobbies in Australia, Box 3356PP, G.P.O., Sydney, N.S.W., and those letters containing news of stations, etc., should be forwarded to reach the above address not later than the 12th of the month for inclusion in the next month's issue.

In your letters please confine your reports to commercial broadcast short-wave stations and telegraphy stations, while actually on telephony. Amateur transmitters will probably be covered in a different section of the magazine at a later date.

In this issue we give a list of all stations heard at our location during the last few weeks. It is not our intention to publish a similar list each month unless readers desire it, as the majority of these stations will be covered in reports from our readers.

However, if readers like this method of listing we shall make it a monthly feature, and bracket after each station the reader's name who reported it.

Stations heard for the first time will, of course, be treated more extensively with all possible tips to enable everyone to log them.

It is only by your letters we can tell if you are satisfied, so give us your opinion.

## NEW STATIONS

In this panel each month will be listed all stations not previously reported which have been heard by readers or at our own location during the preceding month.

| K.c. | Metres. | Call. | Location. |
|---|---|---|---|
| 9,525 | 31 49 | SP31 | Warsaw, Poland. |
| 6,140 | 48 83 | SP48 | Warsaw, Poland. |
| 15,130 | 19 83 | GSW4 | Lisbon, Portugal. |
| 15,290 | 19.62 | VUD4 | Delhi, India. |
| 11.780 | 25.47 | OFE | Lahti, Finland. |
| 15.165 | 19.78 | OZH | Skamlebok, Denmark. |
| 31,600 | 9.49 | W5XGB | Houston, Texas, U.S.A. |
| 9,970 | 30.09 | Radio Tirana | Tirana, Albania. |
| 7,850 | 38.22 | Radio Tirana | Tirana, Albania. |
| 6 090 | 49.22 | Radio Tirana | Tirana, Albania. |
| 15 330 | 19 56 | W6XBE | San Francisco, Cal., U.S.A. |
| 9 300 | 32.27 | LYR | Kaunas, Lithuania. |
| 6.190 | 43 4 | JLT | Tokio, Japan. |
| 9 645 | 31.1 | JLT2 | Tokio, Japan. |
| 6,243 | 48.0 | HIN | Ciudad Trujillo, Dominican Republic. |
| 7,635 | 33.19 | LQP | Buenos Aires, Argentine. |

# OUR SHORT WAVE CORRESPONDENT

*Our short-wave correspondent, Mr. Ra Simpson, has been an enthusiastic lis tener for years, and has long been re garded among the short-wave fraternit as an authority on the subject of D.X stations. He has been a regular contes tant in short-wave contests, winnin many and never failing to gain a hig place. He is well equipped for his job and as he lives at Concord, his report are not those of a man who is favore by a phenomenal location. He is en thusiastic to the last degree, and is eage for your assistance in making his page what he wants them to be—filled with the latest news about everything.*

# S. W. TUNING CHART


**13 Metres**

**GSH**, 13.97 m., 8.45 p.m.-mid.
**GSJ**, 13.93 m., 8.45 p.m.-mid.
**DJJ**, 13.92 m., 9.0 p.m.-10.50 p.m.

☆

**16 Metres**

**GSG**, 16.86 m., 8.45 p.m.-mid.
**GSV**, 16.84 m., 8.45 p.m.-mid.
**DJH**, 16.81 m., 9.0 p.m.-10.50 p.m.
**I2RO8**, 16.84 m., 7.30 p.m.-11.30 p.m.

☆

**19 Metres**

**GSF**, 19.82 m., 8.45 p.m.-mid.
**DJB**, 19.74 m., 8.0 p.m. on.
**TPB11**, 19.83 m., 5.0 p.m. on.
**PCJ2**, 19.71 m., 6.0 p.m.-7.30 p.m., Wed.
**I2RO3**, 19.61 m., 7.0 a.m.-8.0 am.
**YDC**, 19.80 m., 7.30 p.m.-1.0 a.m.

☆

**25 Metres**

**TPA3**, 25.24 m., 5.0 p.m. on.
**GSE**, 25.29 m., 4.30-6.45 p.m.
**GSD**, 25.53 m., 4.30-6.45 p.m.
**I2RO4**, 25.40 m., 10.0 p.m. on.
**JZJ**, 25.42 m., 10.0 p.m.-mid.
**W8XK**, 25.27 m., 7.0 a.m. on.
**W1XAL**, 25.6 m., 7.0 a.m. on.

☆

**31 Metres**

**VLR**, 31.32 m., 6.30 p.m.-11.30 p.m.
**VPD2**, 31.45 m., 8.30 p.m.-10.0 p.m.
**KZRM**, 31.35 m., 7.0 p.m.-mid.
**I2RO3**, 31.13 m., 6.0 a.m. on.
**I2RO9**, 31.02 m., 6.0 a.m. on.
**TAP**, 31.70 m., 6.0 p.m. on.

☆

**49 Metres**

**VK9MI**, 49.92 m., 10.0 p.m.-10.30 p.m.
**W8XAL**, 49.5 m., 9.0 p.m. on.
**HP5K**, 49.96 m., 10.0 p.m. on.
**ZHJ**, 49.51 m., 9.40 p.m.-11.40 p.m.
**GSA**, 49.59 m., 7.15 a.m. on.
**DJC**, 49.83 m., 7.0 a.m. on.
**OLR2B**, 49.75 m., 7.0 a.m. on.

Times shown are not always actual opening times, but indicate in most cases when best reception may be expected.

# OVERSEAS BROADCASTERS

## English and German Stations Good

Listening conditions have generally been good on the Short Wave channels during the month. Late evenings on 19 metres have been particularly good.

**Germany.**—All the German transmitters have been heard with their usual good signals. Calls and frequencies need not be given here, as they are all well known. Perhaps the best being DJR, 15,340 k.c., 19.56 m., during the late evenings. Watch out for DJH on 17,845 k.c., 16.81 m.

**Daventry.**—The same applies to our ever popular Empire transmitters, and they can always be relied upon to give a good signal and entertaining programme. Even CSA on 6050 k.c., 49.59 m., is quite good in early mornings

**Italy.**

**2RO6.**—17,820 k.c., 16.84 m., is one of the best on the 16 m. band around 10 p.m. Frequent English announcements.

**2RO1.**—11.810 k.c., 25.4 m. This one puts in good signal from 9 p.m. onwards.

**IRF.**—9830 k.c., 30.52 m., is very strong between 5.30 a.m. and 6 a.m.

**IRX.**—9650 k.c., 31.09 m., is another excellent morning station, relaying Rome 2RO3, 9670 k.c., 31.01 m. This one vies with IRX in the early morning.

**2RO3.**—9635 k.c., 31.13 m. Frequent English announcements in morning session.

**Czechoslovakia**

**OLR5A.**—Prague, 15.230 k.c., 19.7 m. Heard nightly around 10 p.m.

**OLR4B.**—11,760 k.c., 25.51 m. An excellent signal at 1.30 a.m.

**OLR4A.**—11,840 k.c., 25.34 m. Heard weakly from 8 a.m onwards.

**OLR2B.**—6030 k.c., 49.75 m. Best signal at 6 a.m. daily.

**TAP.**—9465 k.c. 31.7 m., Ankora, Turkey. This is the loudest station on the 31 m. band in the early morning around 6 a.m.

**TAQ.**—15,195 k.c., 19.74 m. Same location on the air nightly till 10 p.m. or later.

**SBO.**—6065 k.c., 49.46 m., Motala, Sweden, on every morning from 7.15 till 8 o'clock.

**SBP**—11,705 k.c., 25.64 m., same location opens on Sunday at 5.58 p.m. with English announcement

**SPM.**—11,740 k.c., 25.55 m., comes on the air every Sunday with march at 5.25 p.m., then lesson in French until 6 p.m., followed by letter in English.

## Finland's Call Addis Ababa Virgin Islands

**Finland.**—The Finnish Broadcasting Station advises the following new calls and frequencies: OIE, 15,190 k.c.; OIH, 17,800 k.c., and OII, 21,550 k.c.

**Peru.**—OAX2A, 11,850 k.c., 25.32 m., now on the air with power of 250 watts. Owner is Rafael Tario H. Hoyle, of Hacienda Chiclin.

**Ethiopia.**—IUD, 18,270 k.c., 16.42 m., Addis Ababa, reported heard from 7.0 p.m. to 8.0 p.m.

**Guadeloupe.**—FG8AA, Point a Pitre, on 7050 k.c., 42.4 m., is now transmitting from 9.0 a.m. to 10.0 a.m., and also from noon till 1.30 p.m.

**Colombia.**—Nearly all stations in this country now have new calls and have practically all moved up to the 61-metre channel, making reception here very improbable.

**El Salvador.**—YSP, 10,400 k.c., 28.85 m., in San Salvador, uses slogan "La Vox de Cuscatlan." May be heard here before closing at 2.0 p.m.

**U.S.A.**—W8XAL, Cincinatti, Ohio, has just been allotted the following new frequencies: 9590 k.c., 11,870 k.c., 15,270 k.c., 17,760 k.c., and 21,650 k.c. Listeners interested in amateur stations may find the following new prefixes of use:—

KB4, Virgin Islands; KB6, Guam.; KC6, Wake Island group; KD6, Midway Islands; KE6, Johnston group; KF6, Baker I., Howland Island, American Phoenix Islands; KG6, Jarvis Island, and the Palmyra group; KH6, American Samoa.

## PORTUGAL NOW ON 19 METRE BAND

THE Portuguese National station, CSW4, has now started transmitting on 15.130 k.c., 19.83 m. Opens every night at 10 o'clock, with clock chiming 12, followed by opening march, then interval signal. A lady then announces in Portuguese, "This is Lisbon, Portugal, CSW4."

Music follows until 10.30 p.m., when lady usually speaks until about 10.45 p.m. A single stroke on a gong is often used between items. We have an idea the call is CSW4, but are not sure of the last figure. Quite recently the Portuguese National stations changed the figures after their call sign, so we must wait for further details.

This station is quite strong, but has a peculiar fluttering effect which makes reception difficult.

## STOP PRESS!

ANOTHER new one for the already overcrowded 9.49 metre band is W5XGB, Houston, Texas, on 31,600 k.c.

We heard him testing at quite good strength on March 2, around noon. If he keeps this level he will be able to stand out above the usual heterodyne squeal.

No address was given, but Ultra High Frequency Station W5XGB, Houston, Texas, U.S.A., should find him.

# TREASURE ISLAND

## SITE OF DXers' CONVENTION

THIS name conjures up visions of pirates and buccaneers on some lonely coral island in the Pacific, but actually is very modern, being the site of the new short-wave transmitter, W6XBE, located in San Francisco Bay.

The writer heard this station testing on 15,330 kc. on February 18 at 1.30 p.m. It will, however, be heard very much better on its 9530 kc. frequency when in regular operation from 6 p.m. till midnight.

Treasure Island will be the site of the 1939 International DXers' Convention from July 11 to 14, when representatives from all countries will meet.

Australia should be represented by some worthy listener, but the financing of such a trip will no doubt be a problem. All short-wave clubs and leagues should endeavor to nominate a suitable representative and pool resources to enable this country to be represented.

* * *

## CHANGING CONDITIONS

DURING the next few weeks a gradual change in conditions should be noticed. Stations on the 31 metre band should be heard a little later in the mornings, while we can expcct a slight falling off in the 19 and 16 metre stations in the late evenings.

Already the 49 metre band has shown an improvement around 9 p.m., when two or three of the Venezuelans can be heard.

## LISTEN TO LITHUANIA

ANOTHER new country now audibl in Australia is Lithuania, throug their transmitter, LYR, on 930 kc., 32.27 m., situated in the capi tal city, Kaunas.

At our location we have heard the at various hours, such as 4.30 p.m. t 5.20 p.m., 12.40 a.m. till 1 a.m., midnigh till 12.30 a.m., and 3.50 a.m. till 4.2 a.m. Strength is poor, with bad fadin at all times, but, as they are the on station usually on around that fr quency, can easily be recognised b Scandinavian type language.

Address reports to Chief of Radi Section, Direction General Des Poste et des Telegraphes, Kaunas, Lithuani

* * *

## VATICAN RADIO

DURING the early part of last mont the Vatican Radio Station, HV was heard broadcasting the variou ceremonies occasioned by the deat of his Holiness Pope Pius XI. Thes special broadcasts came through at ex cellent strength, both on 11,740 kc., 25.5 m., and also on 6190 kc., 48.47 m. weekly transmission for the Philippin Islands is given every Tuesday nigh from 11.30 till midnight. According t an announcement these weekly broad casts may later be given specially fo Australian listeners, who are asked t advise the station of suitable receptio time here. In this regard we woul suggest the same frequency from 11 p.m till 11.30 p.m.

## *Albania on the air*

ONE of the highlights of last month was the reception of "Radio Tirana" in Albania. The writer first heard them on February 1, when they were testing on the 49 metre band.

Then on 9th, 10th, and 11th of the month they were carrying out continuous tests on 9970 kc., 30.09 m., 7850 kc., 38.22 m., and also on 6090 kc., 49.22 m. Announcements were made in about five languages, first their own, then English, French, German, and Italian.

After every few items announcement was given, "Radio Experimental, Tirana, Albania," 3 kw. in antenna. Reports were asked for and acknowledgments promised to all writing in. Address c/o Posts and Telegraphs. While no call letters were given by announcer, they were later heard calling IAC Italy in morse, and on that occasion gave their call as ZAA. This was on the 7850 kc. frequency, and would appear to be correct, as ZA is prefix for Albania.

Here is a chance for listeners to log another country, and thus increase their list of countries heard.

* * *

## NEW POLISH STATIONS

NOT to be outdone by other Euro pean countries, Poland has recen ly opened two new transmitter SP31, 9525 k.c., 31.49 m., and SP4 6140 k.c., 48.83 m. During the last fe weeks we have heard them both oper ing at 5.0 a.m. with announcement b lady in English and other language Unfortunately, they are both interfere with, the 31 metre one by the Russia on 9520 k.c., and the 48 metre one b CR7AA on 6137 k.c.

However, by careful listening th English announcement can be unde stood, when both calls and frequenc are given. Reports are asked for as t quality, etc., and address given as Po skie Radio, Warsaw, Poland. Addres is repeated twice.

We understand the full address i "The Listeners' Research Department Polskie Radjo, Maujowiecks 5, Warsa Poland."

# Listen for these!

## OVERSEAS STATIONS NOW AUDIBLE

Here is a list of Short Wave stations which have actually been heard over the last few weeks. Most of these should be heard by any of our Short Wave fans who have a good set and location. Details of each station are given.

### NORTH AMERICA

**W1XAL.**—11,790 k.c., 25.45 m., Boston, Mass. Heard at good strength around 8.0 a.m.

**W2XE.**—11,830 k.c., 25.36 m., New York. One of the best on the 25 m. band in the early mornings.

**W8XK.**—11,870 k.c., 25.26 m., Pittsburg, Pa. Another excellent station around 8.0 a.m., when using Latin-American beam!

**W8XAL.**—6060 k.c., 49.5 m., Cincinnati, Ohio. One of the regulars on the 49 metre band at night, and can also be heard before closing at 5.0 p.m.

**W3XL.**—17,780 k.c., 16.87 m., Boundbrook, N.J. Puts in a nice signal in the early mornings.

**W3XAL.**—9670 k.c., 31.03 m., same location. Heard well at 4.0 p.m., also weakly when opening at 8.0 a.m.

**W1XK.**—9570 k.c., Pittsburg, Pa.

**XEXA.**—6175 k.c., 48.6 m., Mexico City. Opens at 10.30 p.m. with "March of the Toys," followed by physical exercises to piano accompaniment.

**XEBT.**—6000 k.c., 50.0 m., Mexico City. Comes on the air at 11.0 p.m., usually playing marches for first 15 minutes. Interval signal is three cuckoo calls. Should be heard soon closing at 3.30 p.m. with "La Golondrina."

**XEWW.**—9500 k.c., 31.58 m., Mexico City. This powerful Mexican pounds in from 11.0 p.m. Sends out a very attractive verification card.

**CHNX.**—6130 k.c., 48.94 m., Halifax, N.S., Canada. During last month came in at good strength, opening at 10.0 p.m., and gives religious service till 10.15 p.m., followed by physical jerks until 10.30 p.m.

**CFRX.**—6070 k.c., 49.42 m., Toronto, Canada. This one comes on air at 10.30 p.m., relaying CFRB. Chief engineer Alan Fraser would appreciate further reports from Australia, which if correct will all be verified, if reply coupon enclosed.

**CJRO.**—6150 k.c., 48.78 m., and **CJRX**, 11.720 k.c., 25.6 m., Winnipeg, Man. Heard occasionally Sundays until closing at 5.0 p.m. Verifies promptly.

**XETW.**—6045 k.c., 49.6 m., Tampico, Mexico. Not always audible, but sometimes heard opening at 11.0 p.m.; uses a four-tone chime.

**W1XK.**—9570 kc., 31.35m. Springfield, Mass. Heard testing for the Bureau of Standards at 7.0 a.m. on February 27.

**W8XK.**—15,210 kc., 19.72m. Pittsburgh, Pa. Opens at 11.15 p.m. on Sunday nights.

### ASIA AND INDIA

**ZHP.**—9690 k.c., 30.94 m., Singapore, S.S. Puts in good signal every night and relays Daventry in news session.

**ZHJ.**—6057 k.c., 49.51 m., Penang, S.S. Can be copied but interfered with badly by W8XAL. Closes at 11.40 p.m. and announces on 49.34 m., but are definitely on low frequency side of W8XAL.

**ZBW3.**—9525 k.c., 31.49 m., Hongkong. A regular on the 31 m. band.

**CR9Y.**—6100 k.c., 49.18 m., Macao, Portuguese China. A new transmitter recently on the air. Quality very poor. Reports differ as to last letter of call. Expect definite details for next month's issue.

**JLT2.**—9645 k.c., 31.1 m., Tokio, Japan. A new transmitter used in the morning session, concluding at 7.0 a.m.

**JLG.**—7288 k.c., 41.02 m., Tokio. Used simultaneously with JLT2.

**XGOX.**—15,190 k.c., 19.75 m., Chongking, China. On the air nightly at good strength, but heterodynes TAQ. Gives frequent announcements in English by lady.

**JLT.**—6190 k.c., 48.4 m., Tokio. Opens at 11.0 p.m., simultaneously with JZJ.

**XGXA.**—6980 k.c., 43.00 m., Chongking. Another powerful Chinese with frequent announcement in English.

**XMHA.**—12,280 k.c., 24.43 m., Shanghai, China. Comes on the air every night at 9.0 and gradually builds up in strength. Address: 445 Racecourse Road.

**KZIB.**—9500 k.c., 31.58 m., Manila, P.I. Best after VK3ME closes. Address: Crystal Arcade Building.

**KZRM.**—9570 k.c., 31.35 m., Manila, P.I. A good entertainment station on the 31 m. band. May be difficult to separate from VLR on unselective receivers.

### CENTRAL AMERICA AND WEST INDIES

**HIN.**—6243 k.c., 48 m., and 12,500 k.c., 24 m., Ciudod, Trujillo, Dominican Republic. Opens nightly at 9.40 with march, then call in Spanish. Possibly the second frequency, 12,500 k.c., is a harmonic as it is much weaker.

**TG2.**—6190 k.c., 48.4 m., Guatemala City. Opens nightly at 10.0. Plays numerous marimba numbers.

**TGWB.**—6490 k.c., 46.2 m., Guatemala City. Opens every night at 10.40 at good strength. Physical exercise class till 11.0 p.m.

**HP5K.**—6005 k.c., 49.96 m., Panama City. Opens 10.0 p.m. with "Merry Widow" Waltz, followed by news in Spanish.

**T14NRH.**—9690 k.c., 30.94 m., Heredia, Costa Rica. Heard on Sundays around 10.0 p.m. Numerous announcements in English.

**COCQ.**—8830 k.c., 33.98 m., Havana, Cuba. Heard well around 10.0 p.m., also at 4.0 p.m., before closing. Opening music title, "Siboney."

**COCH.**—9437 k.c., 31.8 m., Havana, Cuba. Fair strength at 11.0 p.m., and can also be heard in mornings at 8.0.

**COCW.**—6324 k.c., 47.4 m., Havana, Cuba. Opens nightly at 9.55; has peculiar hum on carrier, but readily identified.

**COBZ.**—9030 k.c., 33.32 m., Havana, Cuba. Opens nightly at 10.45. Announces in English and Spanish.

**COCX.**—11,740 k.c., 25.55 m., Havana, Cuba. Heard well on Sunday afternoons till 4.0 or later; also after 11.0 p.m.

**COCD.**—6130 k.c., 48.94 m., Havana, Cuba. Opens at 11.0 p.m. with "In a Clock Store," then news in Spanish. Fades out by 11.30 p.m.

**"Radio Martinique."**—9700 k.c., 30.9 m., Fore-de-France, Martinique, F.W.I. Heard at fair strength Monday morning only from about 6.30 till closing at 7.0 a.m., with Marseillaise. Uses six or seven-toned chime before closing announcement. Address: P.O. Box 136.

**HP5A.**—11,700 k.c., 25.65 m., Panama City, Panama. Heard nightly around 11.0. Announces items in English, but usually gives call, etc., in Spanish.

**HI2X.**—11,970 k.c., 25.07 m., Trujillo City, Dominican Republic. Usually heard first Sunday in month around 10.0 p.m., when lottery drawing is broadcast.

**HI3X.**—15,280 k.c., 19.63 m. Sometimes heard instead of the 11,970 k.c. frequency at same time.

**KZGF.**—6770 k.c., 44.27 m., Manila, P.I. Heard working KZGH, Iloilo, at 9.30 p.m.

# Listen for these!

(Continued from Previous Page)

**YDA**—6045 k.c., 49.6 m., Tanjong Priok, Java. On the air nightly, but poor strength.

**YDB**—9550 k.c., 31.41 m., Sourabaya, Java. Can just be heard, but badly interfered with.

**YDC**—15,150 k.c., 19.8 m., Bandoeng, Java. A real entertainment station, and one of the strongest night stations.

**PMH**—6720 k.c., 44.64 m., Bandoeng, Java. Gives programme for local reception, being all Eastern type music. A good "marker" station for calibrating receiver.

**"Radio Philco."** — 11,770 k.c., 25.49 m., Saigon, Indo-China. Are now using this frequency experimentally and asking for reports.

**JIB**—10,535 k.c., 28.48 m., Taihoku, Taiwan. Gives news session in English by lady at midnight.

**JFO**—9625 k.c., 31.16 m., same location as above, and transmits simultaneously.

**JDY**—9940 k.c., 30.18 m., Mairen, Manchukuo. Puts in a nice signal nightly. Relays JQAK. A three-color veri. card is issued, which is well worth having.

**PMN**—10,260 k.c., and **PLP**, 11,000, also carry the usual N.I.R.O.M. programmes.

**XGOY**—9500 k.c., 31.58 m. Location unknown, but thought to be Changtu; heard with excellent volume around 9.0 p.m., also opens at great strength at 7.0 a.m.

**Radio Hanoi** — 11,900 k.c., 25.21 m., Hanoi, French Indo-China. Opens at 9.0 p.m. nightly and may also be heard simultaneously on 9750 k.c., 30.77 m. This last transmission is very distorted.

**Saigon**—6210 k.c., 48.28 m., is also heard from 9.0 p.m. onwards, but interfered with by code.

**HS6PJ**—9500 k.c., 31.58 m., Bangkok, Siam. Sometimes audible on Thursday nights from 11.0.

**COBC**—9990 k.c., 30.01 m., Havana, Cuba. Heard well on opening at 10.0 p.m.: Slogan: "El Progresso, Cubano."

**TGWA**—15,170 k.c., 19.77 m., Guatemala City, Guatemala. Can be heard every Monday morning at 7.0.

## INDIA

The Delhi station, **VUD3**, on 9590 k.c., 31.28 m., puts in a very loud signal around midnight, mostly native music.

**VUC2**, Calcutta, on 9530 k.c., 31.48 m., was heard once at 10.0 p.m., but very hard to separate from ZBW3.

**VUB**—6160 k.c., 48.6 m., Colombo, Ceylon. Heard weakly above noise level every night from 11.0 onwards.

## SOUTH AMERICA

**CXA8**—9640 k.c., 31.12 m., Colonia, Uruguay. Heard on Sunday afternoons till closing at 4 p.m., sometimes 5 p.m. Announces in English before closing down as "Radio Belgran." They rebroadcast LR3, of Buenos Aires, Argentine.

**PPQ**, 11,680 k.c., 25.62 m., Rio de Janeiro, Brazil. Heard calling Panama at midnight.

**HCJB**—12,460 k.c., 24.8 m., Quito, Equador. Opens nightly at great strength at 10 p.m. with march. Slogan: "La Vox de Los Andes." Gives news in Spanish until closing around 11.15 p.m. Strikes one note on gong between news items.

**LRU**—15,290 k.c., 19.62 m. Now being heard nightly at fair strength at 10 p.m. Radio el Mundo.

## AFRICA

**ZNB**—5900 k.c., 50.84 m., Mafeking, British Bechuanaland. Heard on week-days until closing at 5.30 a.m. Male announcer, closes with "God Save the King." Address: P.O. Box 106.

**ZEC**—5860 k.c., 51.2 m., Salisbury, Southern Rhodesia. Fair signal until closing at 6.15 a.m. Gives record titles and numbers after each item. Closes with National Anthem. Address: P.O. Box 792.

**ZRJ**—6007 k.c., 49.94 m., Johannesburg, S.A. Heard with excellent signal until closing at 7.0 a.m.

## MYSTERY STATIONS!

IN this panel each month will be listed stations whose identity has not been determined. Any help as to who they might be will be appreciated, also if you have any doubtful ones yourself, send them in for inclusion.

We will start the ball rolling with these who, so far, have baffled us:—

7200 k.c., 41.67 m. Opens nightly at 9.0, closes 11.15 p.m. Plays Asiatic type music, also European; almost certainly an Eastern or Island station.

9610 k.m., 31.22 m. A Scandinavian station or possibly Latvia, Poland, etc. Heard every morning from 5.0 onwards. Gives one note on gong as interval signal. This one has been heard for weeks now, but no call has ever been heard.

11.99 k.c., 25.04 m. On Sundays a strong Spanish speaking station, closing at 3.0 p.m. Announces as "Radio Telefonica," and gives bugle call just before going off the air. Programme is dance music with chorus in English.

15,300 k.c., 19.61 m. One of the strongest stations we have ever heard. Opens every night at 7 p.m. and plays records continuously until closing abruptly at 7.25 p.m. Not one word is spoken during the entire transmission. This goes on every night the same.

11.99 k.c., 25.04 m. Santiago-de-Cuba. This one opens every night at 10.30 p.m. and can also be heard until closing on Sunday at 3 p.m. with bugle call. No call letters has been heard, but on one occasion heard "Radio Telefonica" mentioned.

9850 k.c., 30.45 m. A new station which plays considerable native type music. Listened to this one till 4.0 a.m. one morning. He plays records for an hour and a half without announcing. At 2.35 a.m. announced in English, "Ladies and gentlemen, you have been listening to station . . . ? on 30.45m., we now continue. Talks can be heard in various languages. Also heard him open one morning at 5.20 a.m., and closed with English announcement at 6.35 a.m., saying it was end of their second evening transmission. Taking times into consideration we would hang out a guess that he is in Palestine, Iraq, Iran or Arabia.

**YV1RB**—5850 k.c., 51.28 m., Maracaibo, Venezuela. Opens nightly at 8.45 p.m., quite good strength. Very slow in verifying.

**OAX4T**—9690 k.c., 30.94 m., Lima, Peru. Heard occasionally on Sunday morning around 7 a.m. Used to be on 9562 k.c., but has recently changed. Will be good around 11 p.m. in a couple of months.

**YV1RH**—6360 k.c., 47.17 m., Maracaibo, Venezuela. "Ondas del Lago." Opens at good strength at 9.15 nightly.

**CB1190**—11,900 k.c., 25.21 m., Valdivia, Chile. Audible from about 1.30 p.m. until closing at 2 p.m. This one is very slow in verifying.

**LRX**—9660 k.c., 31.06 m., Buenos Aires, Argentine. Heard well on Sunday afternoon till closing at 5 p.m. Announce as Radio el Mundo, and also give broadcast call LR1.

**LQP**—7855 k.c., 38.19 m., Buenos Aires. On the air nightly from 10.15, with strong signal.

**ZRK**—6097.5 k.c., 49.2 m., Capetown, S.A. News at 6.0 a.m. Interfered with by YUA. Closes at 7.0 a.m. Also heard around 1.0 a.m. on 9615 k.c., 31.2 m., but very weak.

**CR7AA**—6137 k.c., 48.87 m., Jourenco Marques, Mozambique. Lady announcer usually gives call just before closing at 7.0 a.m. Other transmitter CR7BH, on 11,718 k.c., 25.60 m., also works in unison. Gave details of new transmitter, CR7BB, on 15,240 k.c., 19.69 m. This one not reported heard here as yet.

**"Radio Tananarive"**—6060 k.c., 49.5 m. Opens at 1.0 a.m. with Marseillaise. Good signal but poor quality.

**VQ7LO**—6082 k.c., 49.31 m., Nairobi, Kenya. Closes week-days at 5.15 a.m. and Sundays at 6.15 a.m. Very good signal and easily identified.

**"Radio Tananarive"**—9610 k.c., 31.22 m. Audible from midnight until closing with Marseillaise at 12.55 a.m.

## EUROPE

**HVJ.** 15,121kc., 19.83m. Vatison City. A special transmission was heard at 8.0 a.m. on March 4, directed to Central America.

**12RO12.** 15,100kc., 19.87m. Rome, Italy. Puts in a very nice signal from 7.0 p.m. onwards.

**12RO6.** 15,300kc., 19.61m. One of the best on the 19m. band at 7.0 a.m., also quite good at 4.0 a.m.

**12RO8.** 17,820kc., 16.83m. An excellent signal from 9.0 p.m. onwards, with frequent English announcements.

**EDN.** 10,070kc., 29.79m. Spain. Heard at 7.0 a.m. in special transmission for Germany.

**EAR.** 9480kc., 31.65m. Madrid, Spain. On the air every morning around 7.0 a.m.

**EAQ.** 9860kc., 30.43m. Madrid. Still giving lengthy news service in early mornings.

**TPB11.** 15,130kc., 19.83m. Paris, France. Gives news in English at 7.15 a.m., and is also on the air at 7.0 p.m. at much greater strength.

**PARIS.** 7280kc., 41.6m. Used in conjunction with the 11,885kc. station in early morning.

**DJH.** 17,845kc., 16.81m. Berlin, Germany. A new station, is very good around 8.0 p.m., being much better than DJE.

**PCJ.** 9590kc., 31.28m. Huiyen, Holland. Is one of the best 31m. stations on Monday mornings.

**PCJ2.** 15,220kc., 19.71m. Gives a special transmission for Australia and N.Z. on Tuesday nights. They will shortly inaugurate directional antenna towards Finland.

**OZH.** 15,165kc., 19.78m. Skomlebak, Denmark. Now opens at 10.0 p.m., closing at 11.0 p.m.

**OFE.** 11,780kc., 25.47m. Tahti, Finland. Can sometimes be heard weakly at 10.0 p.m.

**CSW2.** 11,040kc., 27.17m. Lisbon, Portugal. Is a real entertainment station in the early mornings.

**RUSSIAN.** 15,370kc., 19.52m. Moscow, U.S.S.R. Can be heard nightly at 8.0 p.m.

**RV96.** 15,270kc., 19.65m. Moscow. Good at 6.0 p.m.

**RV26.** 9520kc., 31.51m. Is an excellent 31m. band station. At midnight on March 2 they were broadcasting the funeral service of Lenin's widow, while at the same time the station, on 6030 kc., 49.75m., was very loud. This latter one can also be heard at great strength every morning around 7.0 a.m.

It is very difficult to give the correct call-signs of the U.S.S.R. stations, as they do not give them in their own published schedules, and reports from different sources generally conflict.

**LKJ.** 6130kc., 48.94m. Jeloy, Norway. Is one of the morning stations heard above noise level. Same programme can be heard on 11,740kc., 25.55m., at much better strength.

**HBQ.** 6675kc., 44.94m. Heard at good strength on Monday mornings till closing at 6.30 a.m. Announce "Radio Nations."

# *Ultra-High Frequencies*

## AMERICANS HEARD ON 11 METRES

Listeners whose receivers will tune to the 9 and 11 metre bands can experience a new thrill in logging the many commercial and police radio stations operating there.

While at the present time they are all U.S.A. stations, Daventry and Berlin both have frequencies allocated to them in the 11 metre band, and may be in operation later.

All these American stations are especially glad of reports from Australia, and all verify promptly and do not require reply coupons.

At the present time they are at their best around 11 a.m., and a full list of those heard by the writer during February will be found in this issue.

New frequency allocations will come into effect as from April 13 next. A list of these will be given in our next issue.

## *Ultra-High* STATIONS *Heard Recently*

**W6XKG.**—25,950 k.c., 11.56 m., Los Angeles, Cal., 24-hour station, rebroadcasts KGFJ.

**W8XNU.**—25,950 k.c., 11.56 m., Cincinnati, Ohio, relays KSAI, Crosley Radio Corp.

**W9XTC.**—26,050 k.c., 11.51 m., Minneapolis, Minn., relays WTCN. Wants reports.

**W9XH.**—26,000 k.c., 11.5 m., South Bend, Ind., relays WSBT. This one very weak.

**W9XJL.**—26,100 k.c., 11.49 m., Superior, Wis., rebroadcasts WEBC. Usually good signal.

**W9XUP.**—26,150 k.c., 11.46 m., St. Paul, Minn. The loudest on the 11 metre band. Usually relaying KSTP.

**W2XJI.**—26,300 k.c., 11.4 m., New York, U.H.F. outlet for the powerful WOR. Chief engineer particularly wants reports from Australia.

**W9XA.**—26,450 k.c., 11.33 m., Kansas City, Mo. Another loud station relaying KIFE and KCKN. Sends four-page booklet with U.H.F. notes, etc., asking for reports.

**W9XTA.**—26,500 k.c., 11.3 m., Harrisburg, Ill. Only heard occasionally, but when on the air has good signal. Address c/o Schonert Radio Service.

**W2XQO.**—26,550 k.c., 11.25 m., New York. This one is weak, but on good days can be copied when it relays WMCA.

**W4XCA.**—31,600 k.c., 9.494 m., Memphis, Tenn. Can sometimes be heard weakly. Relays WMC.

**W8XAI.**—31,600 k.c., 9.494 m., Rochester, N.Y. Gives programmes from WHAM.

**W9XUY.**—31,610 k.c., 9.494 m., Omaha, Neb. This is the best one on the 9-metre channel.

A few police transmitters can also be heard on 30,100 k.c. and 30,700 k.c., the best being Alameda, Cal.; Los Angeles, Cal.; Newark, N.J.; and Milwaukee, Wis.

All the above U.H.F. stations are heard best between 9 a.m. and noon, but conditions make reception erratic, though the stronger ones are there every forenoon.

New ones on the U.H.F. bands which may shortly be heard are:—

**W8XNO.**—26,100 k.c., in Charleston West, Va.

**WCNY.**—41,100 k.c., Brooklyn, N.Y.

**W4XA.**—31,600 k.c., testing with 100 watts from Nashville, Tenn.

**W6XDA.**—26,600 k.c., location unknown, is expected on the air any time now.

There is also a 1000 watt station being built in Hollywood, Cal., to operate on 26,550 k.c. This should be a good bet for Australian listeners.

### VERIFICATION FROM W2XQO

We have just received a letter of verification from the above station for our reception of December 11 last, advising us that ours was the first report received from Australia. They operate on 26,550 k.c. from 3 a.m. till noon E.A.S.T. All further reports would be greatly appreciated.

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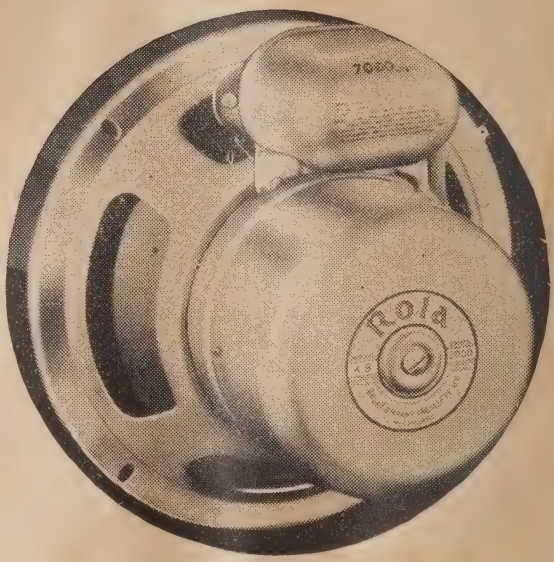


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| K-12 | The next best to a high fidelity speaker. Must be correctly baffled for best results. | 44/- |

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| 8-21 | An eight-inch speaker of extraordinary efficiency. Gives excellent results from low signal inputs. | 42/6 |
| 8-20 | A moderately priced but highly efficient eight-inch P.M. speaker with many applications. | 38/- |
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| 6-6 | A popular six-inch P.M. speaker and one of the biggest selling speakers in Australia. | 27/- |

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# TEST LOUD-SPEAKER

## SPECIALLY DESIGNED AND DESCRIBED FOR THE SERVICE MAN

**Many service men and radio experimenters from time to time have sighed for a universal loud speaker assembly which could be attached quickly and easily to any radio receiver. The equipment described here is simple, and includes an output meter circuit which will allow measurements of both input and output voltages.**

By R. LACKEY, A.M. Inst. R.E. (Aust.) Dip. W.I.A. (Chief Instructor Aust. Radio College.)

N the early days of radio, loud-speakers were very simple devices and practically any type of speaker would operate with almost any re-eiver. Nowadays, with the wide variety f output tubes available and the many ifferent circuit arrangements used in odern receivers, speakers with widely iffering electrical characteristics and onnections are necessary.

A speaker which can be used with ny type of battery or power operated eceiver must be extremely useful to nyone undertaking radio service. An utput meter for use in aligning re-eivers would also be handy, and could e used in conjunction with the speaker.

### EQUIREMENTS

The main requirements for a univer-al speaker are as follows:—

1. Provision should be made for con-ection to receivers, fitted with a 4, 5 r 6-pin speaker socket, or to older ypes of sets provided with two loud-peaker terminals.

2. The connections to the loud-speaker ockets on modern receivers are not at ll standard, and vary considerably with ifferent types of receivers. A flexible nethod of connection should be em-loyed so that the test speaker can be eadily adapted to suit any socket con-ections in the receiver.

3. The vast range of power output ubes at present in use requires a ide range of loud-speaker impedances, arying from about 2000 ohms up to nore than 10,000 ohms for single tubes. When two output tubes are used in a ush-pull circuit, even higher loud-peaker impedances are required. Some rovision should be made for varying he impedance of the speaker so that t can be made to present a suitable oad impedance to the output tube in se.

4. Battery-operated receivers employ nagnetic or permanent magnet dynamic peakers which do not possess a field oil. Mains operated receivers may re-uire a speaker field coil resistance, arying between 750 and 7500 ohms, If he speaker is to operate equally well vith battery and mains operated re-eivers, it must be independent of the ield coil circuits of the receiver. If the ield coil of the test speaker is energised rom a separate power unit, some pro-ision must be made to substitute an artificial field coil of the required resistance, so that the receiver can operate normally.

5. Some form of output meter to operate effectively with sets both with and without automatic volume control should also be included. This requirement is best satisfied by a vacuum tube voltmeter circuit which derives power from the same power unit which energises the speaker field.

### CONNECTIONS

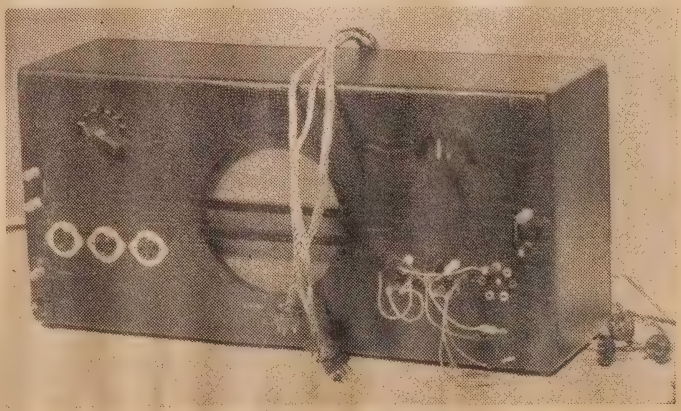
Three cords, each about three feet long, for connecting a receiver to the unit, should be provided. One should be a four-way cord fitted with a four-pin speaker plug at either end, a second should be a five-way cord equipped with five-prong plugs, and the third a six-way cord equipped with six-prong plugs. One end of the appropriate cord is plugged into the speaker socket of a receiver, while the other end is plugged into one of the three sockets mounted on the lower left-hand corner of the unit illustrated. In the case of old-fashioned receivers equipped with two terminals instead of a speaker socket, the terminals should be connected by means of a piece of two-way cord to the two terminals shown in the centre of the left-hand side of the unit, and marked "Input."

The terminals and three sockets mentioned are all connected in parallel with one another, and to the two groups of six wander plug sockets, mounted on the right-hand side of the loud-speaker. Further to the right, there is a group of seven wander plug sockets. The five sockets arranged at the top connect to various tappings on the input transformer of the speaker, so that a variety of loud-speaker impedances are available by plugging into suitable sockets. The two lower sockets of this group of seven connect to a choke coil and a number of resistors which take the place of the field coil in a dynamic type of loud-speaker. This can be easily followed from the circuit diagram.

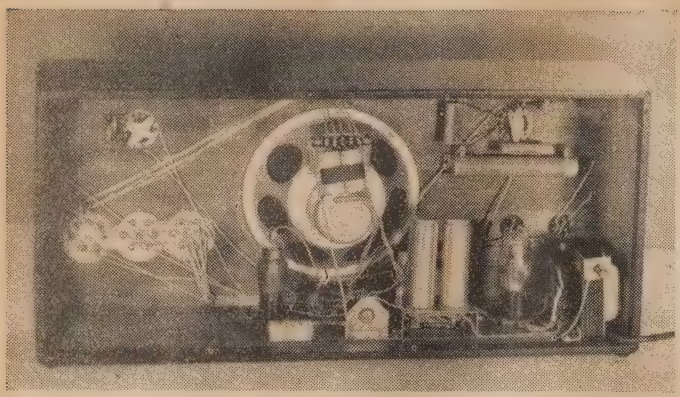
### WANDER PLUGS

A number of wander plugs are joined in pairs by means of short lengths of wire about 6in. long. These links are used for connecting the wander plug sockets which connect with a receiver to the appropriate sockets which connect to the tappings on the input transformer or to the artificial field coil. This arrangement is very flexible, allowing any variations in speaker connection to be handled with ease.

Some receiver manufacturers employ the two thin prongs of a 4-pin speaker socket for the input transformer con-



*The speaker cabinet, front view.*



*A view of the cabinet with the back removed.*

nections, while the two thick prongs are used for the field coil connections. If the particular output valve in the receiver requires a loud-speaker impedance of 7500 ohms, two links would be used to connect the two green wander plug sockets in one of the groups of six, to the two blue wander plug sockets in the group of seven. Another pair of links would be used to connect the two red wander plug sockets in one of the groups of six to the two corresponding red sockets in the group of seven.

## PRIMARY CONNECTIONS

There are five connections to the primary winding of the input transformer. The two outer connections, which connect to the two green wander plug sockets, provide an impedance of 15,000 ohms. The two inner connections, which connect to the blue sockets, provide an impedance of 7500 ohms. Between the centre connection which connects to the yellow socket and either of the blue sockets an impedance of 1875 ohms is available, while from the centre tap to either of the outer or green sockets an impedance of 3750 ohms can be obtained.

In the case of receivers equipped with push-pull output tubes, the yellow socket, which connects to the centre tap, is used for the B plus connection, while either the two blue sockets or two green sockets are used for the plate connections. Naturally, using the two blue sockets provides an impedance of 7500 ohms from plate to plate, and is most suitable for push-pull triode tubes, while the two green sockets provide an impedance of 15,000 ohms from plate to plate, and are most appropriate for push-pull pentode tubes.

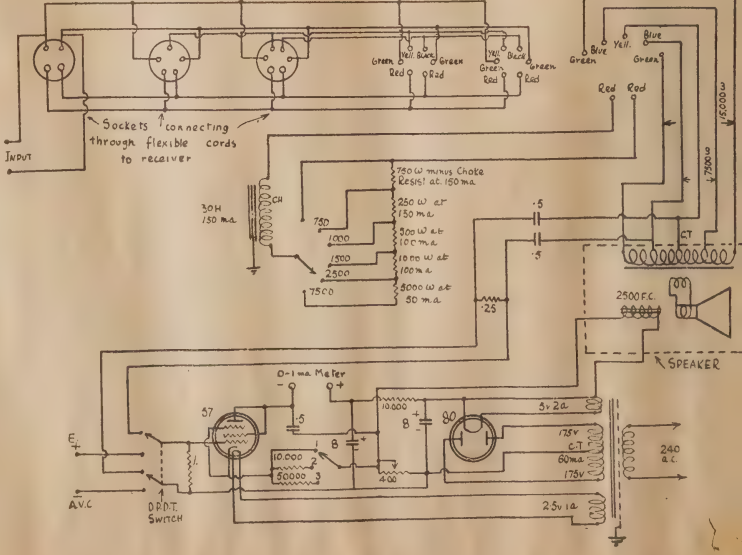
Most mains operated receivers provided with push-pull output tubes are equipped with a five-pin speaker socket. On this the grid pin is usually used for the centre tap connection, the plate and cathode connections for the two plates of the output tubes, while the two heater pins are used for the field coil connections. If the two output tubes require an impedance somewhere in the vicinity of 15,000 ohms from plate to plate, the green sockets on one of the groups of six would be connected to the green sockets in the group of seven. The yellow socket on one of the groups of six would connect to the yellow socket in the group of seven, while the two red sockets in the group of six would connect to the two red sockets in the group of seven.

## ODD SPEAKERS

In the case of non-standard speaker connections in a receiver it is simply necessary to plug the flexible links into suitable sockets in the group of seven and plug their other ends into the appropriate sockets in one of the groups of six. For instance, in the case of a four-pin speaker socket in which the two thin pins are used for the field connections and the two thick pins for the input transformer, the two red sockets in one of the groups of six would connect either to the green or blue sockets in the group of seven, while the green sockets in the group of six would connect to the red sockets in the group of seven.

An examination of the socket connections in the receiver will reveal the manner in which the links should be used.

The second group of six sockets is provided to suit receivers in which one speaker connection and wire is common to both the input transformer and field coil circuits. For instance, in the case of a four-pin socket the two ends of the field coil may connect to the two filament prongs, one end of the input transformer may connect to the plate prong while the other end of this transformer may also connect to one of the filament prongs. The grid prong may either be blank or used for connecting the metal frame of the speaker to the receiver chassis. In a case such as this one of the red sockets and also either the yellow, one of the blue, or one of the green sockets in the group of seven would have to connect to the same red socket in the group of six. It is impossible to fit two plugs into the one socket, but with the two groups of six sockets, one plug can be fitted into the red socket in one group, while the second plug can fit into the corresponding socket of the other group of six.



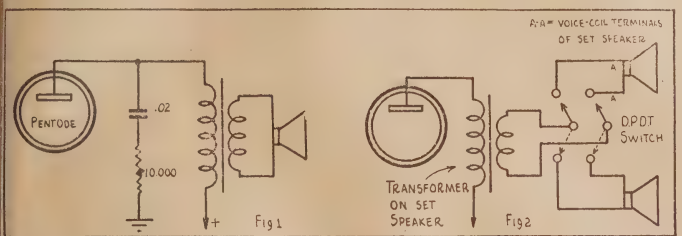

☆

*The circuit. This unit is available in kit form, further information available from the Australian Radio College.*

# EXTENSION SPEAKERS

**We have often been asked for an article explaining how to fit extension speakers to radio receivers. This article has been written for us by a well-known speaker engineer, and he outlined some of the problems involved, together with methods adopted for overcoming them. It will interest enthusiast and serviceman alike.**

THE home that is "wired for radio" is a vision of the past that never properly reached reality. Because the home is not pre-wired there is no reason why this cannot be inconspicuously done. With an extension speaker, in neat cabinet, close to one's work, there need be no frantic rushes to turn down the volume of the radio set in another room every time the phone rings or front door requires answering. The latest type permanent-magnet reproducers are ideally suited to this work, and have a performance at least equal to, and often better than, their electro-dynamic prototypes. As interests are transferred from room to room, so can the extension speaker be moved, with its volume never strident but always providing a pleasant background.




*Showing how a compensating network may be fitted across the output of a pentode valve. Fig 2: Showing how a D.P.D.T. switch may be used to change from one speaker to another.*

## PROBLEMS

Since the field-coil of the electro-dynamic speaker (screwed in the console of the receiver) is already acting as the smoothing choke in the power supply of the set, this speaker is not suitable for extension work. First four wires are needed to let it and the set function, while through being associated with the set's power supply usually a high voltage is present. This creates a hazard if a four-wire cable is extended from room to room. Also, the size of this cable would tend towards an unsightly job. The permanent-magnet reproducer used as an extension speaker requires two wires only, and these can be of bell-wire, which; if it cannot be inconspicuously stapled round the picture rail, can be obtained in a variety of colors to match the skirting-board round the bottoms of the walls. With the methods of connections given in this article there is no harmful current flowing, and the fitting of an extension speaker does not create any hazard as far as Fire Underwriters' rules and regulations are concerned.

## METHODS OF CONNECTION

The easiest method is to run the extension speaker off the secondary leads of the speaker already connected to the set. In cases where an extension is made in this manner the resistance of the line has a direct bearing on results and tone. The wire should be heavy. Bell wire, type 1/20, has a d.c. resistance of about 2 ohms per coil of 300 feet, and as seldom will a run be encountered of 150 feet (for two wires are needed), this material will prove satisfactory and economical.

Runs from room to room can be taken, or, alternatively, a line run and tappings taken off to each room where the extension speaker would prove an advantage.

For the home the above is the simplest method, and at the low volume the extension speaker will not show any slight distortion caused through a mismatch of plate load on the output valve.

Since the primary loading of the output transformer is determined by the turns ratio of the transformer reflecting the voice-coil impedance back, where an extension is fitted any mismatch may partially be offset by creating a simulated loading for the plate of the output valve independent of that provided by the output transformer. As it is, the voice-coil impedance varies considerably with frequency, which, reflected back through the transformer windings presents the ideal plate loading for the valve at 400 cycles only. Since the majority of sets up till this year were equipped with a single penthode output valve, the correct proportioning of this independent load network would be a 10,000 ohm resistor in series with a 0.02 mfd. condenser from the plate of the output penthode to earth. (Fig. 1.)

## SILENCING

In most cases the extension speaker will be the only speaker used, so that some provision must be made for silencing the speaker on the set. The obvious way in cases such as this is to provide a double-pole double-throw switch on the set, so that the secondary leads of the output transformer can be switched either way. (Fig. 2.) This switch can either be mounted on the front panel of the set or at the rear.

For cases where it is desired to have both speakers operating, then switching can be arranged as in Fig. 3. Here the extension speaker line is paralleled across the secondary of the output transformer on the set, with a switch to open either circuit.

## ALTERNATE METHOD

A method is sometimes employed where extension speaker terminals are placed on the set chassis and have no direct connection with the secondary leads of the output transformer. Provision for this system is made by taking leads from the plate of the output valve and from cathode or earth. Isolation of

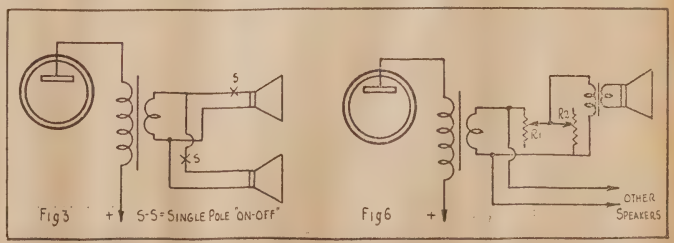



*Fig 3.—This method allows both speakers to be operated together, or one at a time. Fig 4.—Method of volume control described.*

this circuit from high voltages is made by placing a 0.5 m.f. 600-volt rating tubular condenser in each lead. Should a radio set already have these connections provided, then the correct type of speaker would be a permag. type, having an output transformer fitted to it with an impedance of about 15,000 ohms. This would provide for extension speaker volume being not quite as great as that of the speaker on the set, but the extra loading imposed on the plate of the output valve would be so high as not to cause any falling off in tone. The above method also provides an easy method of connecting in earphones to be run at the same time as the normal speaker on the set is used.

## MULTIPLE SPEAKER EXTENSIONS

On systems or installations requiring more than one extension loud-speaker, other methods than those already outlined must be adopted. Since a loud-speaker is a form of electric motor, and therefore requires a driving force, a set that has been designed for the operation of its own loud-speaker will quite successfully drive two speakers, but with any more attached there will be a marked falling off in volume. Since the amount of power required is the sum of that required by each speaker unit, an amplifier in this case will be a necessity, whether it be a separate unit or in-built in the set in the form of large output tubes probably operating in push-pull.

Extension speakers operating on this type of equipment require different treatment, for a low-impedance line feeding direct into the voice-coils of extension speakers is not practical on account of the higher wattage that is carried. Here the D.C. resistance of the extension wire forms a barrier to the current, while capacitive and inductive effects of the line are also encountered. For this type of work a line with an impedance of 500 ohms is generally provided. Special output transformers can now be purchased reasonably providing for the use of single or push-pull to be matched correctly to this figure. Speakers as required can be paralleled across this line. The calculation of the input transformer impedance on each speaker is simply Line Impedance multiplied by Number of Speakers. Should speakers be removed or added from the above, then this will necessitate a change of input transformer on each speaker. It is therefore now usual, especially for public address work, to have as standard on each speaker an input transformer with a 500 ohm primary, and the output transformer on the amplifier so arranged that tappings can be altered on the secondary of it to provide for the varying line loadings. The loading will decrease as additional speakers are added, its effective impedance at any time being an average of the number of speakers connected. (Diag. 4.)

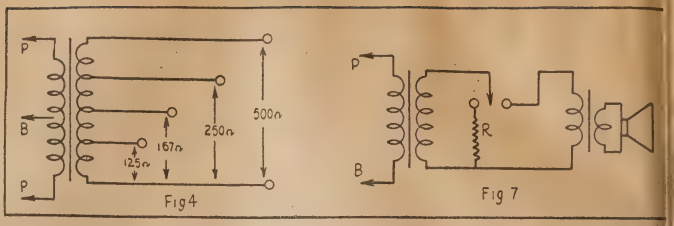
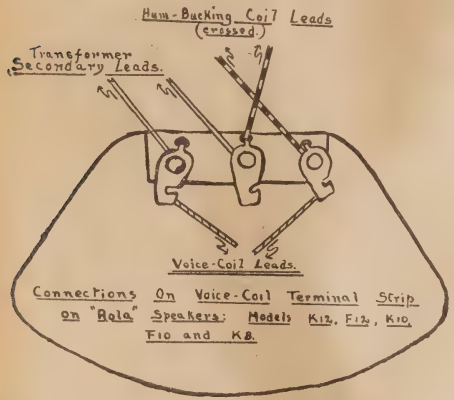


Fig 4 Fig 7

*Fig 4.—A diagram of a variable impedance type of transformer. Fig 7.—A switch for connection either to speaker or load resistor.*

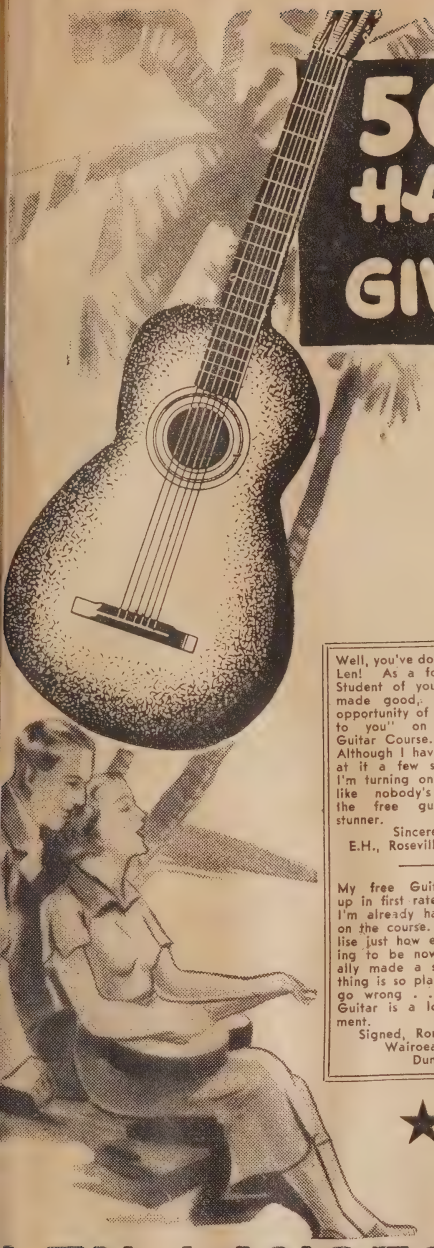



*The terminal strip on a typical loud speaker, showing where connections may be made to the voice coil. When using extension speakers, it is a great help to have these terminals available on such a convenient strip.*

## SPEAKER CABINETS

As the extension speaker cabinet will not have the same baffling effect as the large console cabinet, it is to be expected that some bass will be lost, since the cone of a loud-speaker functions over most of the musical spectrum as a piston. When the cone is so driven by the supplied by the radio set, it moves backward and forward, thus displacing air both in front, as well as behind, the cone. It is this displaced air which the ear hears as sound. In such a cycle the air pushed out in front by the cone moving forward must go somewhere. If no baffle is used on a speaker unit, then this displaced air moves around the back of the cone and fills the partial vacuum created. On the other hand, the higher frequencies,

(Continued on Page 71)



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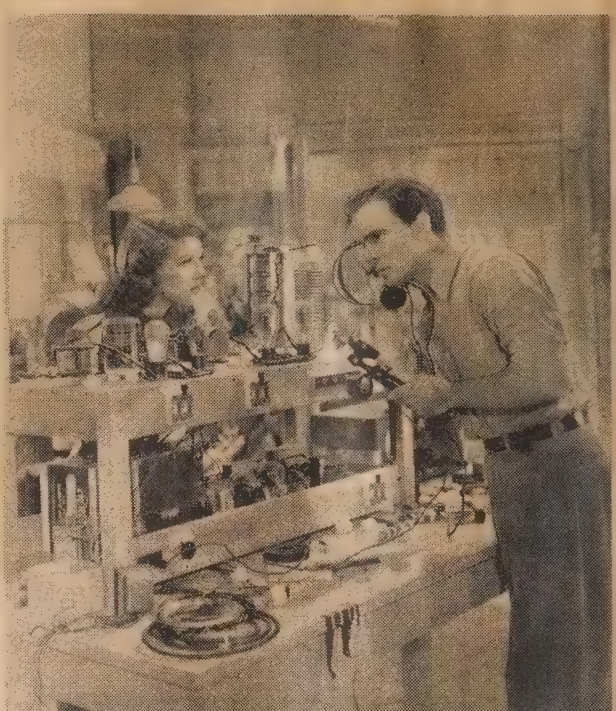
# ABOUT SCREENS



**A film and a projector are, to the average person, the chief requisites for showing moving pictures. But what about the screen? You must spend as much time and thought over the screen itself. The best pictures in the world would be useless without a good surface on which to show them.**



*A splendid "still" from a recent picture, which combines the movie-camera art with that of the amateur radio man. This picture shows the operation of an amateur rig in "Arkansas Traveller."*

IT cannot be emphasised too strongly that the screen is one of the most important pieces of equipment in the projection of home movies.

To the average person, inexperienced in the vagaries of projection, it would appear that any white surface would suffice for the purpose of screening cinema films. This opinion is, no doubt, brought about by the fact that the magic lantern slides are usually projected on a plain linen sheet, while professional shows are seen upon a stretch of apparently unprepared white material.

The amateur projectionist, however, will encounter several problems before he can find a satisfactory surface. For one thing, the illumination employed in the professional cinema is many times more powerful than that available for the amateur, and this, coupled with the fact that a large amount of light in the projector is lost by reason of the rotating shutter, renders it essential to make use of every available iota of light if reasonably good results are to be obtained.

## REFLECTED LIGHT

If a linen sheet is used, a large amount of light will pass through it, and the brilliance of the picture will suffer to the extent of the light so lost, for although you may not have appreciated the fact before, the only light which the spectator sees is that which is reflected from the screen in his direction. For this reason, it is essential that, no matter what type of screen you employ, it shall have a solid surface which will not permit the passage of light through it.

Now, there are several types of screen available for amateur projection. They are the plain white dull-surfaced, the silver, and the beaded screen.

## EASILY MADE SCREEN

Let us consider each one in turn as to its merits and disadvantages.

The plain white screen can be made easily at home. The simplest form of screen may be constructed from two curtain poles and a length of material. Not any material, however. The best for this particular use is heavy white drill—similar to that used in the making of dentists' and doctors' coats. Purchase enough for your screen area. Next purchase a packet of white size and a bottle of a mixture called Nu-Dope. This may be purchased at any paint store. Mix the two into an easy-flowing paint and coat your material to whatever size picture you require to show. When the surface is dry, turn it around and paint the back of the material likewise. This will give you a flat white surface, and the facing front and rear will successfully prevent penetration of light rays and subsequent loss of brilliance.

When both coats of paint are dry, tack top and bottom edges of your material to the broom-sticks, being careful to avoid creases in the surface. Screw two eyelets in the top roller for hanging. This finished screen will give you as brilliant an image as you may expect with a flat white surface, but it has a disadvantage in that it cannot be rolled. Rolling the screen will crack the surface. Because of this, some handymen prefer to mount their screen upon a framework of wood, stretching the material tight before painting it. This method produces a tighter

## YOUR CONTRIBUTIONS

**Are there any points you want to know about making pictures? Do you know anything about making pictures? In either of these cases, why not write to us, and let us know your reactions and experiences. Your letter will be a great help in assisting us to make these pages interesting to you and to others. Address your letters to "Radio and Hobbies," Box 3366 PP, G.P.O., Sydney.**

*Only a simple scene involving an old car and a couple of men, but just look at the set-up! Is it any wonder that the film experts are able to make such perfect pictures when they have all this to help them?*

face, certainly, but it is a more elaborate procedure than the roller type.

## ADVANTAGE OF WHITE SCREEN

A flat white screen has some advantages over the silver and beaded variety. An ordinary white screen may be viewed from any angle and the intensity of the illumination of the picture will remain unaltered. The other types have a less wide range of viewpoints. With the silver and beaded screens, the picture should be viewed as nearly as possible from some point on a line drawn between the projector and the screen. On either side of this line, the farther one moves away the more the picture dies in intensity.

Thus it will be seen that if one contemplates showing movies in a wide room, or in any apartment where, of necessity, the audience must be spread widely, the flat white screen is by far the most suitable.

Then what are the advantages of the silver and beaded screens?

Brilliance of image. It has been found that a silver screen will show a picture at least one hundred per cent. brighter than the same picture projected on a white screen. This is particularly noticeable in color photography, where the highest reflecting values are needed to bring out the different subtle gradations of color in the film. Again, because of the special backing of the silver screen, the absorbing of light is practically nil. And this, as explained, adds to the brilliance of the image.

## THE GLASS BEADED SCREEN

Of late, a third type of screen has made its appearance on the market, in the form of the beaded screen. This shows a particularly brilliant picture, brighter even than the image of the silver screen, but it suffers from the very material drawback of costliness. This is because such screens as these require very skilful workmanship. They are composed of many thousands of tiny white glass beads, each one faceted like a diamond, and pressed into an adhesive substance which is backed with cloth. Because of the facets, each tiny bead acts as a light reflector when the beam from the projector is played upon it.

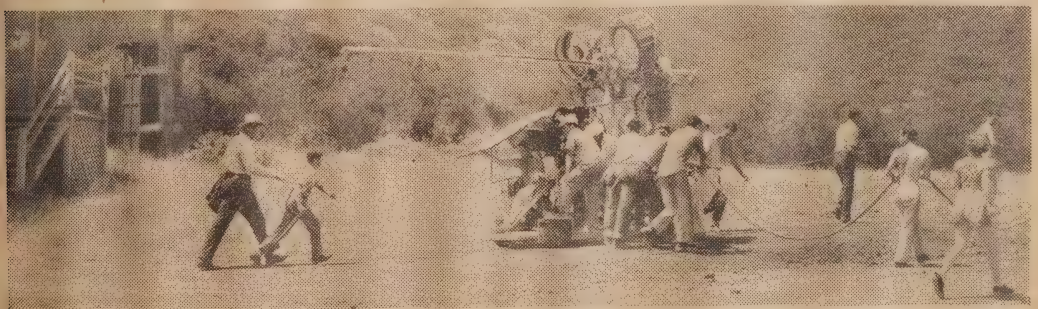
Bead screens, because of their brilliance, are more suitable to a large auditorium than to the living-room of a private house. Here, necessity forces the projectionist to sit his audience comparatively close to the screen, and the reflecting power of a bead screen is such that if the programme is overlong, your audience is prone to complain of the high-powered brilliance.

And particularly is this the case in color films.

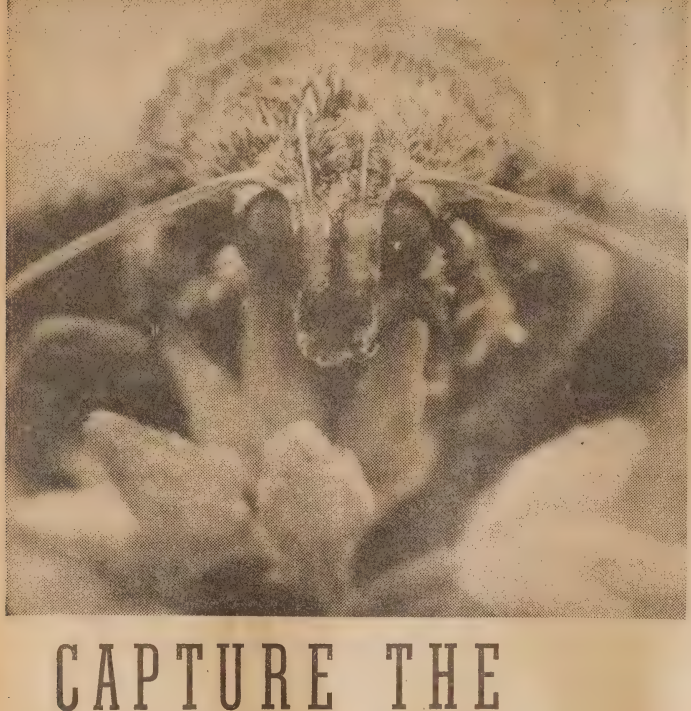
Both the beaded and silver screens, however, have the advantage of handiness. They are of the roller-blind, self-standing type, and can be pulled up into position, where they will remain erect without further support. When closed, they shut into a long narrow box, which can easily be carried under the arm, or by the handle.

## DIFFERENCE OF COST

Such screens as described above may be purchased from £3/15/- upwards to £10. But the home-made white flat surface screen may be made for ten



*And this is no more than a picture of a man and a boy walking along the road. But here you have the outside story of the shot. The audience in the theatre have no idea that there are so many others only a few feet way from the actors. Note the travelling camera carriage.*



*Microphotography is also interesting. Here is an amateur study of a fierce-looking "bug." There are few more fascinating studies than that which concerns the photographing of minute objects enlarged to many times their original size. This is only one example of what an amateur can do.*

# CAPTURE THE MOMENT

**As with most things, there is no royal road to success with a camera. One must pass through the initial stages, and know very well indeed just where he is going, before consistently good pictures can be achieved. This article covers some of the things the beginner must consider when starting out.**

I HAVE a friend whose interest in photography is intense yet careless—rather like his golf. He wants to take good pictures, but considers that it is just a matter of pointing some sort of a camera vaguely at something or other, pressing the trigger, and going casually through certain processes described on the package-labels of developers and printing-papers.

The first couple of times he played golf the result was similar. Like many new players, he had phenomenal luck. It was only when his luck began to desert him that he realised there was more to it than swinging a club in the general direction of the ball, or pointing his camera in the general direction of an object and pulling the trigger.

He came and asked me what was wrong with his photography.

I said: "Buy up about twenty years' supplies and we will go to the South Pole and find a nice quiet spot, and maybe I can give you a rough idea before we have to come back for more supplies."

But despite all that, he persevered with both me and his photography. He kept coming back. And back. There was no alternative. I had to start with him from the beginning. His name is Frank, and he became interested enough to give up golf.

I said: "You asked me to start at the beginning. So you have to sit and listen to me talk about cameras—what they are and what they mean."

"You can't frighten me," he said. "I have sat right through a Parliamentary debate. I am quite resigned."

"Very well. To commence . . . a camera, of necessity, is a light-tight instrument. Basically, it is boxlike. It has a film or plate (sensitised) at one end, and a lens at the other. Furthermore, this film and this lens are so placed that they are exactly opposite each other; the lens points straight at the plate (in the precise middle of it, to be exact).

"In the majority of cameras this lens can be moved backwards and forwards, away from or towards the film. In some, it may be moved up and down also, and from side to side.

"So that disposes of the camera in theory and essentials. Now for cameras themselves. The most popular of all types is the hand-camera—that is, one you can carry around with you for use without a stand or tripod. I take it for granted that you want to buy yourself a camera. You don't know anything about them. . . ."

"All right," he broke in. "There's no need to rub it in."

"I am not talking to you," I told him. "I am speaking to a mythical person who is deeply interested in what I am saying."

He threw up his hands in surrender and I went on.

"You want to know what to buy. I can only tell you this, explain and describe various cameras to you, and let you do the rest . . . there is only one thing to remember—cameras with gadgets and elaborate devices on them might take super-excellent photos under amazingly poor conditions—but the more elaborate they are the greater the margins of error.

"In other words, don't buy a camera that needs an expert to get the best out of it. To go to an extreme in order to illustrate the point, a simple and cheap box camera will give (under normal conditions) a higher percentage of good results at the hands of an inexperienced operator than the most valuable and complicated instrument ever turned out.

"Mind you, I don't suggest that you buy a box camera—although you could

*When the enthusiast tires of ordinary pictorial photography, he can always turn to other subjects, such as the moon, pictured here as seen through a telescope.*

☆

o worse, as I've just pointed out—but do suggest that you buy one you can andle properly . . . and, except for 's size and weight, the reflex is probbly the best of all—but we'll come to hat later. . . ."

"What are we coming to in the meanime?" Frank asked, helping himself o my cigarettes.

"Hand-cameras," I said, pocketing the package ostentatiously. "They fall into two classes—those built to take roll-films (which are greatly in the majority) and those for plates or film-packs. Roll-film, as you know, can be loaded into and unloaded from the camera in broad daylight—although you will do well to remember always to get into shade before loading or unloading; or if no shade is available, do it in the shadow of your own body. If you don't do this, strong sunlight is likely to penetrate the roll and blacken the edges of your film."

"I've noticed that on my films," he said, "and wondered what it was. Have you got a match, too?"

These samples of amateur photographs are from the collection of the late Ross Hull, who was accidentally electrocuted when carrying out television experiments in America last year.

I gave him one, and went on: "Plates have to be loaded into and taken out of special carriers—called dark-slides—in a dark-room. Film-packs are merely a number of films cut to the correct size and sold in a metal, light-tight casing. The beauty of film-packs is that any number of exposed films can be taken out of the casing and developed and printed without disturbing those which are unexposed.

"With roll-films, of course, development and printing must wait until all on the roll have been exposed, or the unexposed portion of the film must be wasted."

"You talk like a fellow I used to play golf with," Frank said. "Only I used to have to buy him drinks. . . ."

(Continued on Page 67)

*Fig 1.—Ordinary nail about to be thrust through the finger . . . .*

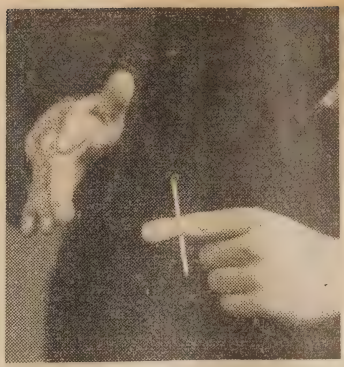


*Fig 2.— . . . nail right through.*

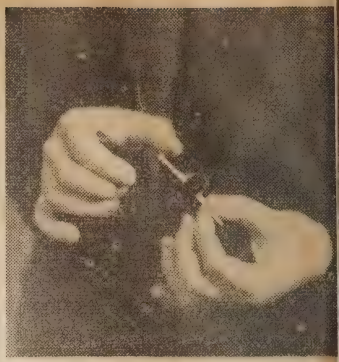


*Fig 3.—The ordinary nail is exchanged for this duplicate, which has a small loop of wire to fit around finger.*

# MAGIC

Mystifying by magic is something which has fascinated young and old from the very earliest times. It is not at all hard to master a few simple tricks which will enable you to put on quite a good show, if you take the trouble to practise your acts. Our contributor here outlines many simple tricks which you can try out for yourself.

*by Barry Kent*

IT will be my aim in all articles about conjuring and magic to give a number of tricks that can be performed by the average person. They will not require any elaborate apparatus, and will not require any special ability or sleight-of-hand dexterity. The outlay of large sums of money in following your hobby will not be necessary. If any advanced students of magic require more details of stage apparatus, tricks, illusions or sleight-of-hand, drop me a line personally and I will give you further particulars in writing to suit each individual person.

## PROGRAMMES

When you have mastered a few simple tricks—and, remember, it is frequently the simple trick that is the most baffling—try and arrange a programme, of, say, twelve minutes continuous magic. In this programme, arrange for a bright, quick trick to be performed first. Your opening trick should command the attention of your audience, and it should, of course, have a big element of mystery about it. It should not be a long drawn-out trick. Short, quick, bright, colorful, is the aim. The opening should gain the immediate attention of onlookers. If you succeed with a good opening, the rest of the programme becomes somewhat easier, and you will

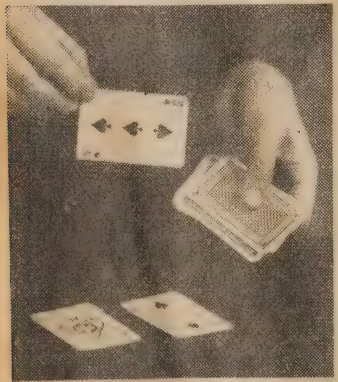


*Fig 4.—Counting cards. Showing "three" being counted out and turned over on to table, following "one" and "two."*

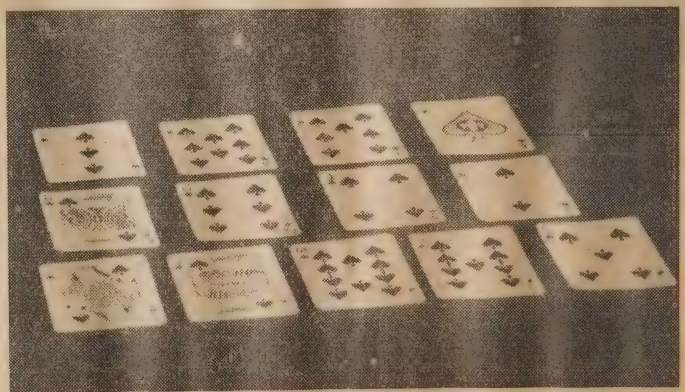


*Fig 5.—Showing the order in which cards are previously arranged. Reading from back row, left to right.*

ve greater chance of success. If your st trick fails, the rest of the perform- ce will probably suffer as a result.

## LECTION

I realise it may be difficult for many you, with a limited knowledge and perience of magic, to select good open- ; tricks, and good closing tricks; even perienced performers have great dif- ulty in finding suitable and effective ening items. Always be on the look- t for a good opening trick to add your programme. Select a trick at you like and can perform well, en build your programme with other teresting and puzzling problems. Your ıal mystery should also be "snappy," ıd if possible finish with the mystery max coming quickly. This creates final favorable impression with your ıdience, and has the effect of causing at appreciation which will follow if ou have arranged and given a neat rformance.

Do not include too many tricks in e one programme. It is better to per- rm five items in twelve minutes—

nd to do them well than to do half n hour of badly arranged and care- essly performed tricks.

## HE FIRST ENTERTAINMENT

Before your first entertainment is iven, go over every item carefully, nd rehearse it over and over again n front of a mirror if possible. Imagine ou have an audience before you, and hen give the whole performance alone —every trick in its correct order. You night like to lock yourself in your oom for these rehearsals. It is also good idea to speak aloud the words— r "patter" as it is called—when re- hearsing, thus you will gain confidence nd there will be no waste time when iving the actual performance. Next month I will have more to say about the value of carefully prepared patter and its part in the success or otherwise of the trick. For the present I will merely ask you to practise each item singly, and then the programme as a whole, but—practice, practice, and more practice will be needed until the entire programme is perfect and ready for presentation to an audience.

# HEY PRESTO

Hey Presto! Abracadabra!

Greetings to you all, my magical friends.

Now, before I commence describing a few more mysteries and tricks for you, I would like to say how pleased I was to receive so many letters from boys—and quite a number of girls—in various parts of Australia and New Zealand, who are interested in Conjuring and Magic as a hobby. It seemed like real magic to find interested friends in, N.S.W., Queensland, Victoria, South and Western Australia, and even New Zealand, and I must thank you all for your good wishes. There was a slight delay in replying to a few letters owing to my absence from Sydney on tour for several weeks, however, I have now replied to all enquirers and I wish you all success and happiness in your associations with your new hobby — Conjuring and Magic. If you have any problems in connection with Magic, or if you want any advice which I may be able to give you, do not hesitate to drop me a line at any time. A few letters I received did not call for a full written reply, and I have included my comments on these at the end of the article in this issue. It is my intention to reply to all future inquiries, either by letter or through these columns each month, and I want you to feel that this is a free personal service to those interested in this fascinating hobby.

Yours Magically,

Barry Kent.

*Fig 6. — Seven matches in a row. Solution shown at bottom—NIL.*

*Fig 7.—Match being placed in centre of handkerchief. Duplicate is seen in bottom corner, half exposed in hem. Before doing the trick it should be pushed into the hem about one inch, well out of sight.*

## PROFESSIONAL MAGICIANS

At present in Australia and New Zealand, there are a number of clever world-famous magicians appearing on the professional stage, and if you have the opportunity you should try to see their performances. You will learn much about this interesting and educational hobby, and at the same time be sure of enjoyable and mystifying entertainment. Watch for their opening and closing tricks and the manner in which they build up a programme. The magicians I have in mind at present and who are successfully mystifying the people of this country are "CHANG" —a clever Chinese magician, with a full

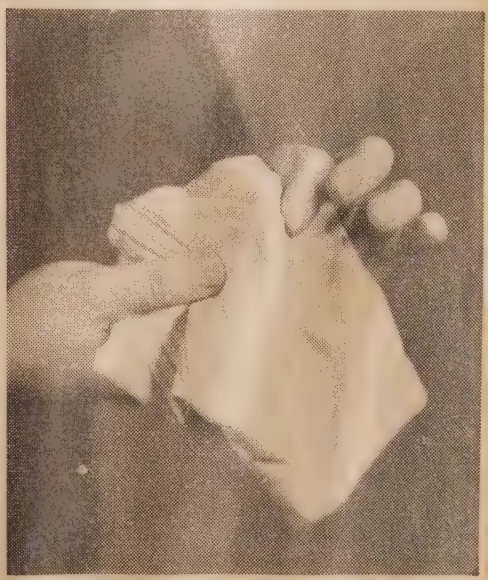


*Fig 8.—Match being broken by member of audience. Actually, the duplicate in the hem is broken.*

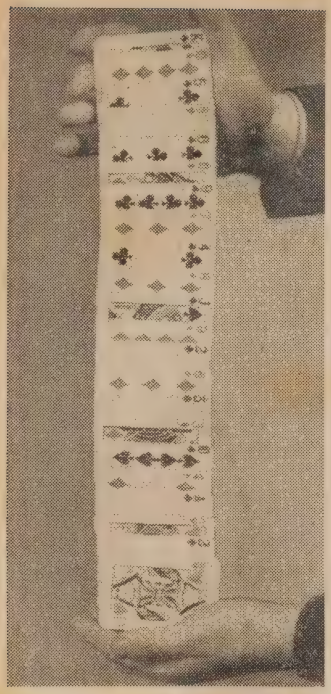


*Fig 9.—Playing cards running from hand to hand.*

*Fig 10.—The cards have been previously joined together by threads of strong cotton, as shown in the illustration.*

evening show, and "NICOLA," with a magical revue of the world, also with an evening's performance of two and a half hours magic and mystery. Appearing in the principal vaudeville theatres with a very clever sleight-of-hand act of about ten minutes is "JIMAE," a clever American, who does the impossible with cards, billiard balls and cigarettes. See these master magicians if they come your way, and look for those points I have been telling you about.

## MYSTIFYING MAGIC

Here is a mystifying effect that will cause your friends to wonder. A large nail is passed for examination, and after it has been returned to you you immediately pass it right through the finger till the point and about two inches of the nail is seen on the other side, with the audience barely two feet away. The nail is then withdrawn, and again passed for examination. How to do this astounding trick will be seen in Figs. 1, 2, and 3. If you are handy with a steel saw and soldering iron you will be able to make this little apparatus yourself.

## CURIOUS COUNTING CARDS

Follow this carefully, and try it out on your friends. The performer takes a small handful of cards face down and begins by taking the top card and placing it on the bottom of the pack, and at the same time commences to count "ONE"—O-N-E-, placing each top card singly on the bottom of the pack each time he calls a letter of the word "ONE"—then he turns over, face up on to the table, the next card (which is the fourth card), as he calls out the word "ONE"—and the card is the ace, or one. Next he begins to count "TWO" in the same way, T-W-O-, and with each letter called out places the top card on to the bottom of the pack. The next card turned over on to the table face up is then the TWO. This is continued with "THREE," right up to "TEN," "JACK," "QUEEN," and "KING." Each time a card is discarded and turned over on to the table it is the card spelled out. This is a fascinating puzzle, and you will have much fun with it. See Figs. 4 and 5 for the solution. Thirteen cards only are used, ace to King of any suit. They are pre-arranged in this order: 3 8 7 A K 6 4 2 Q J 10 9 5, the THREE being the top card with the pack facing down. Have these cards on top of the pack ready. When about to perform the trick, just mention that for your next problem you will use a few cards only, and take off the top thirteen pre-arranged cards, without counting. Then proceed to count O-N-E, and so on, as described above.

*Fig 11.—Safety match being struck alight on sole of shoe. Except to a magician this is not possible.*

*Fig 12.—Showing how. Part of the box—the striking part—is gummed to the shoe where shown, prior to performing the trick.*

*Fig 13.—Brush right off. No, it can't be done, no matter how you try.*

## MAGICAL MATCHES

This is a good match puzzle. Take seven wooden matches and place them in a row upon the table. Now, the problem is to take away only one match, and yet have nothing remaining on the table. This is much easier than it seems. After removing one match, alter the arrangement of the rest to Spell the word NIL. The word NIL being formed is, of course, the same as nothing.

Another clever and mystifying match trick is where the performer takes a marked match and wraps it in a pocket handkerchief. A member of the audience is allowed to break the match in halves, through the folds of the handkerchief. But when the magic words are said and the handkerchief is opened by the performer again the match is discovered to be whole again, and can be examined for the identification mark. To do this baffling trick a handkerchief with a hem is used, and secretly, beforehand, a duplicate match has been inserted in the hem of one border. See Fig. 7. Now spread the handkerchief out upon the table and place the borrowed and marked match in the centre, and then fold the four corners over to the centre, taking care to fold the corner containing the duplicate match last. Next, pick up the handkerchief and ask someone to break the match through the folds, actually offering them the duplicate. Now, a few magic passes—the handkerchief is opened, and the unbroken match is shaken out. See Figs. 7 and 8 for further explanation. To finish up with, you then take the match—a safety match—and strike it on the sole of your shoe. This causes great surprise, for as you know safety matches will not light except by using the box provided. Beforehand, take a matchbox and break the striking side away from the box and gum it with a good quality gum to the sole of the shoe, between the heel and the sole. Now, all is easy. Lift your foot slightly, away from the audience, and strike the match. This will be a surprising finish to your few match tricks. Figs. 11 and 12 will show the method.

## MAGNETIC CARDS

After doing a few card tricks, the performer is seen to take the pack, and, drawing one hand away from the other, causes the cards to jump from one hand to the other—two or three feet—and repeat it several times, something like playing an accordeon. Then run them up the arm with beautiful regularity. This is a very astonishing effect, and can be done with comparative ease. See Figs. 9 and 10. You will see that the cards are carefully joined at several points with strong black thread. It is not very difficult to prepare a pack like this, but for a small charge the packs can be purchased already made up by most of the magical dealers. Such packs are usually known as an electrical pack of cards.

*Fig 14.—Balance coin between two pins. This requires considerable care. A new coin with a good edge is best.*

## HYPNOTISED COIN

This is an amusing trick, and one that will cause most people to wonder how it is done. Take a small coin, say, sixpence or a shilling piece, and rest it on the palm of the left hand, face up. See Fig. 13. Now tell your friends that they can have the coin if they can brush it off your hand with an ordinary clothes brush. Try as they will, the coin will not leave your hand. Get a coin and brush, and try it; you will be surprised.

## SPHERICAL SPINNING

This stunt or effect is one which will require a little practice before you will be able to work it successfully. Take a new penny or a two-shilling piece, and balance it between two pins, as shown in Fig. 14, then, by gently blowing on the coin, it will spin on the two points in a remarkable way, having the appearance of a particularly clever trick. Hold the pins firmly, and increase the blowing as the coin spins round and round. See Fig. 15.

## DO NOT EXPOSE

Now, again in conclusion, I must ask you not to expose how you perform these clever little tricks to your friends. By guarding the secrets of our magical hobby we can create a better magical entertainment and greater wonderment for our audiences. Next month I hope to say something about the big magicians' clubs, and how they function for the betterment of magicians and magic, also I will have a number of clever balancing and juggling experiments for you. In the meantime do not hesitate to drop me a line if I can assist you in any way with your hobby.

**REPLIES TO CORRESPONDENCE**

B. O'H. (Granville): Thanks for information. Will send as requested.

Glenys W. (Yeelanna, S.A.): Book is named "Paper Magic." Write to Will Andrade, 173 Pitt Street, Sydney.

J.K. (West Bankstown): Will Andrade can supply. See address above.

Leo J.P. (Stawell, Vic.): Goods purchased and sent; hope satisfactory. Sorry for delay. Thanks for wishes.

V.J.C. (Westmere, N.Z.): Congratulations on performance. Will write.

I.R.G. (Onehunga, N.Z.): Will compile list and send. Thanks.

E.J.D. (Armidale): Certainly, if you send particulars.

T.C.P. (Gunning): Would be too costly. Yes; it is a good trick. Will ascertain for you and write later.

L.W. (Masterton, N.Z.): Am preparing list and will post letter. Good idea.

F.R.B. (Geelong, Vic.): Special paper pattern is necessary. Silk is best for handkerchief tricks. Write again.

P.L.S.W. (Rama-Rama, N.Z.): Trick too difficult to make. Would suggest purchasing from reliable dealer of apparatus. List sent.

Tom B. (Wagga Wagga, N.S.W.): Sleight-of-hand is difficult to learn, but with practice you should succeed. "Modern Card Manipulations," by Neil is a good book. List sent.

*Fig 15.—Coin is set spinning by gently blowing directly on to it. Hold coin firmly with the pins.*

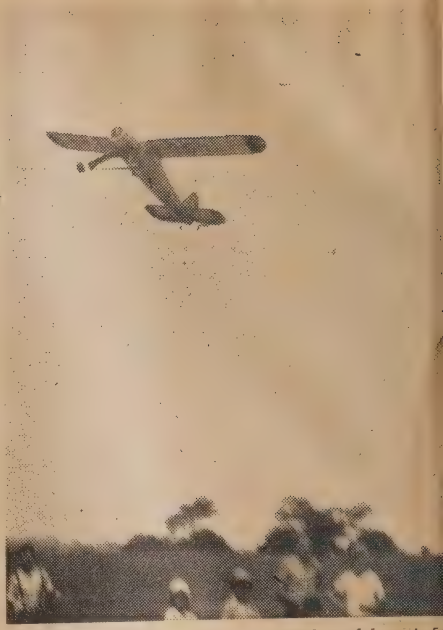
Elsie McD. (Peakhurst): Handkerchief tricks are very suitable for girls. Try Will Andrade. "Tricks With Handkerchiefs," by Professor Hoffman.

Desmond C. (Auckland, N.B.): Imp. bottle costs 1/-, post free at most dealers. Write again. Thanks.

*Who builds*

# MODEL AEROPLANES

**This is a preliminary article introducing our model aeroplane section, conducted by an enthusiast well versed and experienced in matters affecting models. Next month he will present a specially designed flying model guaranteed to give results!**



*Here's an outsize in rubber-powered models. A 5f wing-span job by Fred. Manning, of Waverley.*

DRIVE around the suburbs of Sydney any Sunday morning and, every so often, you will come upon a group of 20 or 30 men and boys flying model aeroplanes.

Should you have chosen a day on which a championship contest is being flown, you will find the fliers concentrated at one field, where 50 or 60 of the best in the metropolitan area will be keenly contesting the championship trophy. As well as the fliers and their assistants, a big contest attracts hundreds of spectators.

There is little wonder that this sport should be so popular. It is essentially outdoor, and yet it requires a maximum of skill and ingenuity.

Not that a beginner cannot get results. Really amazing things have been achieved by even the veriest beginners. Flights of many minutes have been recorded, and distances of many miles covered.

It is a hobby that is absorbing and fascinating. You can make it a lifetime study or you can dabble in it for amusement. It depends entirely on your temperament and the time at your disposal. In any case, you'll have lots of fun if once you start.

After that, how do you feel about it? You'd like to learn more about it? All right, then; let's get started.

## WHAT IT COSTS

First of all, what does it cost? Well, you can build a glider for about ninepence, and a really efficient glider is a complete flying model which can, in capable hands, compete against the average rubber-powered model. Flights of up to almost nine minutes have been obtained by a glider that cost ninepence to build. It all depends on the design in the first place, and then the ability of the flier. The beginner can expect flights of 30 seconds to 1 minute from his early gliders, and achieve distances of 100 to 200 yards.

On the other hand, if you feel so inclined, you can spend £7 or £8 and build a petrol driven model—called in the vernacular a "gas" model. However, a beginner would not be well advised to start with a gas model. The most popular type is the rubber-powered machine. This can be built at a cost that varies from half a crow to 7s or 8s, depending on the size a design of the model.

Commercial kits, which contain pla and ready-cut parts, can be obtain from the model supply stores. Th simplify the work considerably, but course will make your hobby more e pensive. For the beginner, a kit mak things much easier, but your season model builder takes pride in overcon ing difficulties by his own ingenuity.

## THE TIME IT TAKES

Having decided that you can affo the cost, you will want to know ju how much of your time will be tak up. It all depends on the amou of time at your disposal. The glider spoke about could be built in a Satu day afternoon; leave it overnight allow the cemented joints plenty time to dry, and you can take it o Sunday morning and fly it.

Of course, if it is your very first mod it would probably pay you to take mo time over it to ensure that you g everything right. A rubber model a different proposition. Here, there a more details to be attended to, a the building of a good rubber mod of say 40-inch wing span would occu two complete week-ends and most your spare time during the week b tween. Here, again size counts a gre deal. A simple 24-inch fuselage mod could be built in one week-end.

The most difficult job you will e counter will be carving the propell It would probably be wisest to buy ready-carved propeller, of a suitab size, for your first model. Here, aga

(Continued on Page 71)

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*A 40in. "gas" model by Ray Wilson, of Randwick, shows how small a gas model can be. The motor is rated at 1-7 h.p. The man in the picture is Harry Higlett, of Balmain.*

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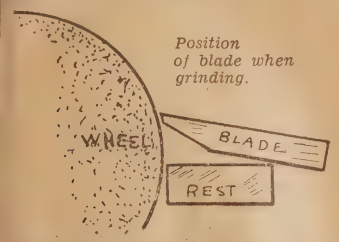
# HINTS ON LATHE WORK

NEVER before has the home craftsman been so well catered for as far as reasonably-priced machine tools are concerned. Not the least among these tools is the lathe—an extremely important member of the machine tool group, as, indeed, lathework is a craft on its own.

The writer served an apprenticeship term of five years, as well as three years of continuation school, in the learning of this particular craft, so readers will realise that the following chat is, of necessity, brief!

## GRINDING TOOLS

One of the first things that the amateur turner will be required to know is how to properly grind cutting tools. The shapes and sizes of such tools are legion, but the principles involved in grinding the cutting edges will be, in most cases, those given for the simple tool, as shown in our sketch. Again, different materials to be turned, as well as the grades of tool steel for cutting, will vary considerably, and this calls for experience in tool grinding for maximum results.




*Position of blade when grinding.*

On looking at the sketch, showing a simple roughing tool, you will notice that several angles must be watched. "A" is known as the cutting angle, and "B" is the front clearance. "C" is the top rake, and "D" is the side rake, while "E" is the side clearance. Strictly speaking, these angles should be ground to suit the particular material in the chuck, but, of course, the amateur will usually find that he can turn out a fair job on most any material using the same tool.

**This is probably because the time factor does not usually enter into amateur work, but it should be remembered that proper tool grinding allows of a maximum amount of material being removed in a minimum of time, together with a good finish and less re-dressing of the cutting tool.**

If we are to grind a tool for, say, mild steel, then the proper angles would be, for A 60deg., B 6deg., C 20deg., D 15deg., and E 6deg. respectively. On the other hand, for cutting brasses, the proper angles would be 75, 15, 0, 0, and 6 degrees.

Lathe tools, other than heavy roughing, should be set to the height of the lathe centres—never below. For diameters under 3 inches, roughing tools should be at centre height, above 3 inches. They may with advantage be set a little above centre, the amount depending upon the diameter of the work and the front clearance of the tool. For taper work, however, the tool point should always be at exact centre height both for turning and boring.

Tools should not overhang from the tool-rest any more than is actually necessary, and they should be packed to bear on the edge of the tool-rest that is nearest the work. In this way, the most likely cause of chattering will be avoided.

Old square files broken into suitable lengths may be shaped into tools for almost any amateur work. The files should first be wrapped in cloth, then clamped in a vice, and broken off with a hammer. The temper should be drawn by heating to a dull red, then allow to cool slowly. The remaining operations will be forming to shape, grinding, and, finally, re-hardening of the point only by re-heating and plunging into cold water. If too brittle a point results from this method, a quenching medium of oil, such as fish oil, rape, or cotton-seed oil, should be used. In any case, if proper tool steel is purchased, the maker's recommendations regarding use and tempering should be followed. Most tool steel merchants will gladly supply tempering color charts and other printed information dealing with their particular lines.

## STEEL AND IRON

Cast-iron and high-carbon steel are turned at the slower speeds, mild steel a little faster, while for brasses and aluminium the cutting rate may be speeded up considerably. A little experience will soon tell just what speed is best to use.

To keep the job cool and preserve the point of the cutting tool, in most cases a cooling lubricant should be constantly applied by using a drip-feed arrangement or merely a small paint-brush. For steel this lubricant may consist of soapy water, but it should be remembered that cast-iron, brasses, and bronzes should be turned dry.

## WHAT IS YOUR HOBBY?

Have you some ideas, hints, or tips which might help someone else? If you have, we are anxious to hear about them. Write to us, giving the details of your idea, and if you can manage a small sketch or photograph as well, so much the better. We will pay for worth-while articles.

# *Capture The Moment*

(Continued from Page 61)

"As I said a moment ago, box-cameras are easiest of all to operate. You need no experience, there is no focusing to be done, and the lens has a small aperture—which means that you can take pictures without making any adjustments—at any distance from infinity to a few feet in front of the camera . . . about ten feet, to be exact.

"This is called a fixed focus camera. Of course, you can't expect to get perfect pictures in anything but a good light, even if you're using a fast film; but you will get good average results, particularly with the latest types of box-cameras.

"For example, there is the Ensign 'All-Distance' job. In this instrument the makers have provided a slight lens-shifting adjustment that makes it possible to photograph objects as close as three feet away . . . and now what were you saying about buying me a drink?'

"I said——"

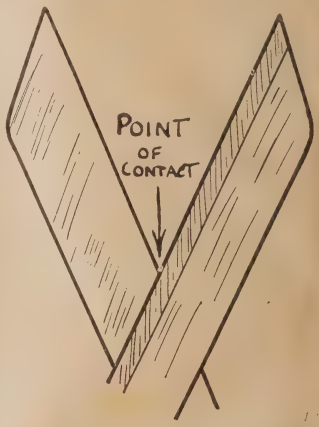
"Good. I heard you the first time. We might go further into the matter of cameras when we get back."

But I'm afraid we didn't get back in time. The subject of cameras had to wait until I saw him later.

# SHARPENING SHEARS

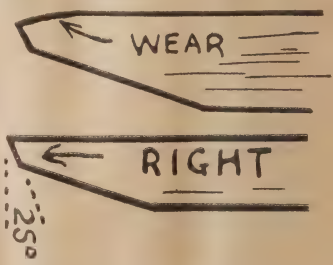
MANY common domestic cutting tools are properly classed as shears; scissors, hedge cutters or any tools with a scissor action are examples.

The cutting action of knives and shears is quite different in each case. A knife is a single-bladed instrument, having one edge ground to a very acute angle, and it relies upon the keen edge so formed to slice the material which




rests upon a predetermined support. Naturally, this cutting edge is not robust and frequent resharpening is required.

A shear is a two-bladed instrument with a cutting action (correctly termed a shearing action) quite different to that of a knife. In this case the blades are ground to a very obtuse angle, usually at about 25 degrees with respect




to the inner or contact side. Furthermore, as the blades are curved and also pivoted at one end, the cutting edges have only a hairline contact. This point of contact of the blades is where the actual shearing of the material takes place and, of course, travels the length of the blade as the edges are closed together. This curvature or "set" of the blades is to ensure that the shearing edges are in intimate contact for the whole of their length of travel. Without this set no amount of correct

**(Continued on Next Page)**

# REPAIRING FAULTY GAS TAPS

## A DIFFICULT JOB MADE EASY

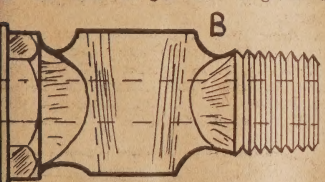
THE faults that are likely to occur with the common gas tap are few and simple and they can easily be rectified by the "man of the ouse." Of course, before attempting iechanical adjustments, an understand-ig of the functions of the few parts iat make up a gas tap is essential.

A top is made up of four parts—the ipered plug, the body, the water, and ie screw. Slight variations from iis make-up may come to light; ir instance, some taps have no :rew but carry a nut on a threaded rojection of the plug. However, the rinciple remains unchanged.

The tapered portion of the plug is ccurately machined to fit into a hole f similar shape bored in the body and ; held firmly in place by the screw. 'he washer prevents the on and off otation of the plug from working the :rew loose.

### HOW THE TAP WORKS

The body is drilled along its axis nd, therefore, presents a straight nrough passage for the flow of gas. 'he plug has a hole drilled transversely nrough the tapered portion so that 'hen inserted in the body the plug one position still presents a passage or the flow of gas but if given a




*Details of a common gas tap plug.*

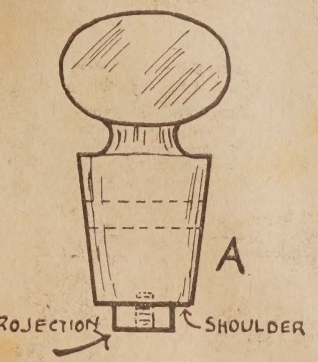
uarter turn it effectively plugs up the entre section of the body and there ; then no flow.

### LEAKY TAPS

Without a doubt, the commonest rouble is that of leakage. The appli-ation of soap to the faulty tap is defi-itely not a satisfactory method of re-air, because any seal thus formed is oon broken away when the tap is urned on or off. Besides this, we must emember that we have only attempted o plug up a leak around the outside f the tap, but if the tap leaks extern-lly, we can be sure that it is leaking **nternally** as well, even when in the off" position and gas is escaping nrough the various burners and rings, tc.

A leakage indicates that the tapered lug is not fitting properly into the ody. This may be verified by pressing he plug firmly into the body when in nost cases the leakage ceases. The emedy, of course, is to see that the screw is tightened so that it properly draws these parts together.

If the plug still appears to be loose, we then know that the tapered surfaces are worn and that the plug fits more deeply into the body than when in the




new condition. This state of affairs can be rectified by filing metal a **little at a time** away from the side of the washer and the projection on the plug. In extreme cases it may be found necessary to take a little material away from the shoulder as well.

**It is important** that the parts are filed with a smooth file a **little at a time** until the correct fit is obtained. If too much material is removed the action of tightening the screw will lock the parts solidly together and the tap will then be inoperative.

In extreme cases the foregoing measures do not have the desired effect. This means that the tapered surfaces have been scored by the passage of grit. In this case to effect a satisfactory repair we have to go one step further and lap the plug and body together.

This "lapping" process is similar to that used in "grinding in" an automobile engine valve.

In our case, however, a very fine grinding paste is used so as to secure a polished and perfectly leakproof surface. An excellent paste may be made by mixing knife polish with water or we may use ordinary metal polish, starting with the sediment from the bottom of the tin and finishing off with the thin liquid.

The lapping action consists of smearing paste over the plug, which is then inserted into the body and rapidly turned backward and forward under pressure. Occasionally the plug should be lifted and dropped again in a slightly different position. After a few minutes' lapping the parts may be wiped, cleaned and tested. Be sure that no paste remains in the bore of the body or the hole in the plug.

### TIGHT TAPS

A tap that is hard to turn may be so because the plug is either siezed into the body or is fouled by foreign matter.

In the first case a smart tap on the head of the screw will be all that is required to free the plug, whilst obviously in the second instance the tap should be dismantled, the parts cleaned and then re-assembled.

# SHARPENING SHEARS

**(Continued from Previous Page)**

grinding of the edges would prevent material from wedging itself between the blades.

The blades of shears seldom require resetting (speaking of a good quality, of course); usually the lightening of the pivot screw or rivet will have the desired corrective effect. Subsequent loosening of the screw can be prevented by resting the head on a solid support and giving the end of the screw a few light hammer blows. In effect, the end of the screw is rivetted over. One common type of shear does not have a pivot pin, the blade shafts are extended in a curve which is rivetted together. In this case the curved portion is twisted until the blades fit snugly together.

### GRINDING

The amateur gardener or home mechanic who desires to keep his tools in tip-top condition cannot afford to be without a simple grinding wheel. Whilst some tools are soft enough to be dressed with the aid of a file and vyce, others are extremely hard and require treatment with an abrasive wheel of some kind. These grinding wheels may be purchased at quite a reasonable figure. They are manipulated by turning a crank-handle and are designed to clamp on to a table or bench.

The sketches show better than words how the actual grinding should be carried out. We mention, however, that **on no account** should material be removed from the **inner**, flat surfaces of the blades. The edge should be ground back until the worn strip which shows on the inner face has gone.

Blades which have been subjected to considerable grinding are narrowed to such an extent that the extreme tips do not close together. This fault may be rectified by filing back the shoulders of the blade shafts just below the pivot pin.

*Some idea of the power of a good air rifle can be gained from these photos. On the extreme right is the slug before it is fired, and the others show this slug after it has hit, (1) steel plate, (2) concrete, (3) dirt.*

# AIR-GUNS AND RIFLES

Few realise that there are air rifles as well as air guns. The rifles, having rifled barrels, are far more accurate. They are available in several powerful models, as told in this story.

Target and game shooting is fine fun and a pastime which every Australian might well be encouraged to pursue.

To those who live in the country shooting comes about readily, but for those less fortunate people who live in the suburban areas there is not the same opportunity; at least, that is how it seems until you consider the air-rifle.

**Anyone who uses an ordinary rifle in a suburban backyard is sure to run into trouble with the neighbors.**

But only elementary precautions are necessary with an air-rifle, and it is easy to keep within the law.

## ACCURACY

With memories of childhood days spent with an air-gun, you might doubt the accuracy of any type of air-rifle for targeting purposes, but such fears need not have any foundation.

The cheap types of air-guns, fitted with smooth bore barrels, are not accurate enough for serious target work, but, on the other hand, there are plenty of air-rifles, with barrels rifled to shoot special slugs, which are just about as accurate at short range as a good match rifle under normal circumstances.

## NOT CHEAP

Unfortunately, these accurate air-rifles are not cheap, ranging in prices from about 55/- to £6/15/-, but they are very cheap to operate.

**No ordinary cartridges are required, and the small leaden slugs cost only a few pence a thousand. Best quality slugs are 4d per tin of a hundred, while cheaper types are available**

This offers a considerable saving over the .22 calibre cartridges, which cost from 3/6 to 5/- per hundred in the long rifle type.

## TRIGGER PULL

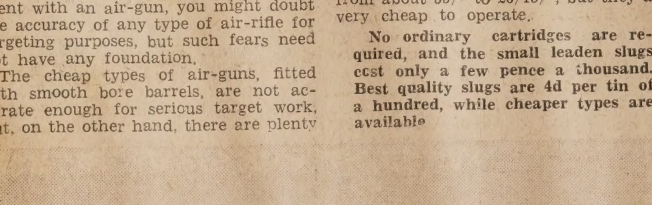
One of the difficulties with certain air-rifles is the heaviness of the trigger pull. With a good .22 calibre target rifle it is possible to get a very light and sweet pull, but with the air-rifle the trigger has to release a powerful spring. As a result, it is sometimes stiff and sometimes inconsistent. Efforts to overcome this difficulty have been made, however, and some air-rifles are fitted with a special adjusting screw just ahead of the trigger guard, which is adjusted until the trigger will hold the main spring without becoming too stiff.

## CALIBRE

All of the accurate air-rifles which we noticed in Sydney shops were of the .177 calibre, but it is also possible to obtain air-rifles firing a .22 calibre slug. When in Melbourne recently the writer did some shooting with a Webley air-rifle of this calibre, recently imported from England. It was a fine job, too, with an aperture type of rear sight, but we understand that they are only imported to special order. They are a little on the costly side, too.

The larger calibre does not necessarily mean greater accuracy, but results in harder hitting, as the velocity of the slug is about the same with either bore but the weight is twice as heavy, resulting in a much heavier impact. This is not at all important for target shooting, but makes the air-rifle much more effective for killing game.

**(Continued on Page 72)**



*The air rifle used for the tests detailed, a "King Diana."*

# XTENSION PEAKERS

(Continued from Page 56)

apart from the lower frequencies ich fall in the above piston-range of cone, are generated by a vibration the speaker cone itself. Thus, the aker without a baffle will reproduce high tones at maximum, but will k almost entirely the low tones.

lthough an extension speaker cabi- must necessarily be small and pro- e a baffle which will give reinforce- nt to vibrations as low as about 200 les only, speaker manufacturers, ough their many years of experience the design of speakers to fit the cabi- of the mantel model set, can give mit which compensates for this lack baffling.

The new Rola type 6-6 P.M. is a unit inently suitable for an extension aker, having a far better acoustic tput than previously, with an im- oved frequency response. This unit n be obtained minus transformer en required as an extension speaker, d with a voice-coil impedance of 3 ms works satisfactorily with the usual namic speaker in the set.

## OLUME CONTROL ON XTENSION SPEAKERS

On systems where speakers are run om a high impedance line—as against line at voice-coil impedance, inde- ndent volume control is sometimes lled for. This can be applied as per g. 6. Whereas ganged potentiometers e shown, these are not available as andard units. Ganging can be ac- mplished by removing the back cov- s of the potentiometers and fitting pension spindles. The resistance of should approximately equal the mbination of the impedance of the imary of the transformer fitted to e extension speaker and the resist- ce of R2. R2 itself should have a re- stance of at least five times that of e primary impedance of the extension eaker transformer. The combination orks as series-parallel resistors, in hich R1 cuts in series resistance as e impedance of the speaker trans- rmer changes with the reduction of e parallel resistance, R2.

Fig. 7 shows a system of muting a eaker without disturbing the balance the line. The resistor R should be proximately 25 per cent. higher in sistance than the primary impedance the speaker transformer. The switch a single-pole double-throw. This stem can also be followed on the ice-coil side of the speaker trans- rmer, or used where there is no input ansformer on the speaker.

# Who Builds MODEL AEROPLANES

(Continued from Page 66)

the model supply stores come to our aid with ready-carved or partly carved propellers that can be obtained quite cheaply. However, after a little practice, you'll be able to carve your own and turn out a really professional job.

Incidentally, you'll need a decent knife to carve that propeller, one with a good steel blade that stays sharp—and that brings up the question of tools.

## VERY FEW TOOLS NEEDED

A model builder's tool kit is very simple. The sharp knife we spoke about is essential, together with several old razor blades for odd jobs. Keep a new blade handy for trimming the silk tissue, used for wing covering. These together with a pair of long-nosed pliers—similar to radio pliers—for bending steel wire, and you have your tool kit.

There is, however, one other accessory that most builders use to-day. That is a balsa stripper. This is an adjustable gauge that allows you to cut from a sheet of balsa strips of any thickness from 1-32nd inch to about 2 inches. It simplifies work a great deal, replacing the laborious method of straight edge and knife. This gadget sells quite cheaply, too, actually costs about 1s 6d.

## . . . AND THE MATERIALS

Balsa wood is the universal model plane timber, because of its extreme lightness, and the ease with which it can be worked. It can only be obtained from the model supply stores and is obtainable in stock sheets 36in. long, 3in. wide, and varying in thickness from the thinnest veneer to 1in. thick. Almost any size can be obtained if specifically ordered.

The range of sheets included 1/50, 1/32, 1/16, 1/8, 3/16, &c. (these dimensions being fractions of an inch). These sheets are cut into strips and assembled in a framework. The joints are glued with acetone cement, which can be bought ready made, or can be made by dissolving clear celluloid in pure acetone (obtainable from wholesale chemists).

The framework is covered with Japanese tissue, a special lightweight tissue that is obtainable from model supply houses at a negligible cost. There are many adhesives for attaching this tissue, ordinary boiled starch-paste applied sparingly being as efficient as any.

Steel wire, which comes in coils or straight lengths—the latter preferred by most builders—is used for prop. shafts, undercarriages, hooks, &c., and comes in a wide range of thicknesses.

That just about completes the outfit. There are various accessories, such as washers, dope for tightening the covering, tints and lacquers, and all the etceteras, that you will need from time to time, but their use is pretty obvious.

## POWERING

Power for a model plane is supplied by twisted elastic. This elastic comes in lengths and is looped into a skein of sufficient size to provide ample power.

A small lightweight model could be flown on six strands, each 18in. long, of 1-8 x 1-30 rubber; while a large heavy model may require as many as 18 strands, each 4ft. long, of 3-16 x 1-30 rubber. As many as 1000 turns could be wound into the latter motor if care were taken, although 800 would be a safer mark; while the smaller motor would take 400 to 600 turns safely.

In this manner, motors can be made to run as long as 60 or 70 seconds; but it is very difficult to obtain longer runs unless climb is sacrificed. When a model flies 10 or 20 minutes, the major portion of the time is spent gliding on air currents.

## NEXT MONTH, R. & H. SPECIAL

Next month we will present the plans of the R. & H. Special. It is an 18in. wing span glider, based on the design which holds the present Australian record of 8min. 43sec. The design has been altered to incorporate refinements that will make the model easier to handle, and yet still keep it in the record class. Beginners who build this glider can expect flights of several minutes from the model.

# ANSWERS TO CORRESPONDENTS

## RADIO

**W.W.S. (Newcastle)** asks if we have described an amplifier which was designed exclusively for use with crystal pick-ups. He mentions that most circuits have too much gain for the comparatively high voltage output of these pick-ups, making it necessary to run the amplifier with the volume control back a bit, thereby affecting tone.

A.: Yes, our high-fidelity amplifier of 1934 was designed to give just enough lift to operate from a crystal pick-up, and we have a simpler type of amplifier at present on test. Although at first glance there would appear to be no reason why retarding the volume control should affect quality, it does do so in practice, perhaps due to the distributed capacity introduced. Incidentally, it is bad practice to use close shielding for a crystal pick-up, as the capacity effects spoil the loading. With a low-gain amplifier hum is easy to avoid, and we prefer to run unshielded wires from the crystal cartridge.

**W.B.H. (Penrith)** wants a circuit for a small portable, running from dry batteries only.

A.: We haven't any circuit on hand which would suit your purpose, but one of the jobs on the laboratory bench at present is a battery version of "Little Jim," and we hope that it will be ready by the May issue.

## CAMERAS

**P.L.J. (Rose Bay)** inquires for Gaevert papers.

A.: You should have no difficulty in getting supplies of Gaevert films and papers. International Radio Company, of Castlereagh Street, are wholesale distributors, and if you ring them and mention the size you require, they will tell you where you can get supplies.

**M.I.N. (Katoomba)** has been told that the faster the film the worse the grain.

A.: Yes, this is more or less correct, and, generally speaking, the slow films are of finer grain. The trouble has been dealt with very effectively, however, and a great deal of enlargement becomes necessary before grain trouble is experienced with even the fastest of modern films. To avoid grain trouble, we suggest plenty of exposure and slight under-development. Keep the actual time of development down to a minimum for any particular solution. We like the D-72 borax developer. If you haven't the formula, we can easily let you have it.

**F.H.H. (Bondi)** writes several pages on the subject of focus, but appears to be hopelessly mixed.

A.: The whole subject of focus is a very large one, and we can't hope to cover it adequately in a few lines, but here are some of the fundamentals which you don't appear to have grasped. In the first place, the smaller the aperture, the greater the depth of focus. By depth of focus we refer to the distance between the nearest and farthest objects which are reasonably in focus. But for any given aperture it is easier to get distant objects in focus. For example, it may be possible to get two objects, one twenty and the other fifty feet away, both in focus with a certain aperture. But you can't say that this aperture gives you a depth of focus of thirty feet, as you will soon prove if you try to focus one or two objects, one at three feet and the other at thirty-three.

## TELL US YOUR TROUBLES

IT is our intention to make the "Answers to Correspondents" section of the paper a guide, philosopher and friend to anyone in trouble over his or her hobby. Provided intelligent questions are asked, the answers, we know, are of deep interest not only to the inquirer, but to anyone else who happens to be interested in the subject dealt with. It has been our experience with "Wireless Weekly" that the Queries pages have been amongst the most widely read of all. In RADIO AND HOBBIES we will have a much better scope to deal with troubles of all kinds, which we will iron out to the best of our ability.

Keep your questions, if possible, to subjects of general interest.

Don't write and ask us things such as, "What is Radio?"

Make your questions brief and to the point; we will make our answers the same.

We will try to answer every query received in reasonable time in the first available issue.

Our address is RADIO AND HOBBIES IN AUSTRALIA, Box 3366PP, G.P.O., Sydney.

## SHOOTING

**K.K. (Canberra)** wants to know whether the 297/230 type Morris tube cartridges have greater power than the .22 calibre.

A.: The actual bullet is heavier, but the hitting power is not as great as with the latest types of high-velocity .22 long rifle cartridges. The old Morris tube cartridges only used black powder, which accounts for the low velocity. Probably the most serious drawback to the type you mention is that corrosive properties of the powder making tedious cleaning necessary to avoid rusting and fouling. With modern .22 ammunition you need clean the barrel every six months, and still won't have trouble with rust.

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## AIRGUNS AND RIFLES

(Continued from Page 70)

This brings us to the point that we feel we ought to stress—that the air rifle is not comparable with the normal .22 calibre rifle when it comes to real out-of-doors hunting, rabbit-shooting and so on

**We feel sure that anyone who expects to get results from an air-rifle on the same scale as the modern "pea-rifle" is sure to be disappointed**

But the air-rifle has its own advantages, and we strongly recommend it for target shooting in places where a "real" rifle would not be allowed.

### VELOCITY

The muzzle velocity of a good air-rifle is surprisingly high, about 600 feet per second, as against about 1000 feet for the normal .22 calibre long rifle cartridge and 1200 feet for the "high-velocity" type of .22 calibre long rifle cartridge.

Some idea of the hitting power can be gauged from the weight of the slug used, 8 grains for the .177 calibre slug and 16 grains for the .22 calibre slug. For purposes of comparison, we might mention that the weight of the bullet in a solid-pointed .22 calibre long rifle cartridge is 40 grains.

### PERFORMANCE

Some idea of the practical performance of a decent air-rifle can be gauged from the way in which the slug will tear its way through a jam tin.

Tested at a range of about five yards we found that the .177 calibre slug would go clean through one side of the tin, and make a split on the other side.

As regards accuracy, we found that it was possible to score a "possible" with five shots, all hitting a 3-8in. bull at 10 yards, hand fired. From the way in which this was done it appeared as though the rifle was absolutely accurate at this range.

### MODELS AVAILABLE

The particular rifle used for these tests was one of Japanese manufacture, branded King Diana, and sold by Mick Simmons at 55/-. A similar brand of rifle, but with smooth bore barrel, is also available at a cheaper price, but we would not recommend it for serious target shooting.

Among other types of accurate air-rifles (with rifled barrels) we might mention the "Haenel," which is available from Sil Rohu at £3/5/-, and two B.S.A. models, which are available from all good gunshops. The prices of the two B.S.A. models are £4/5/- and £6/15/-.